

# QST

*Devoted entirely to* **AMATEUR RADIO**  
*Published by the*  
**AMERICAN RADIO RELAY LEAGUE**



SY 3KI	BZ7	KU	9	40B
KOREA	JAPAN	CHINA	UT	50
8AB FRANCE	EGYPTIAN	RUSSIAN	CHINA	TURKEY
AUSTRIA B27	93CB DENMARK	AUSTRALIAN 5CR	SWEDEN B03	
ORNEO CLUB	ATHENS GREECE B5	SCOTLAND 7H00T	AFRICAN K29	SWISS 3N
ALASKA 4ICE	BRAZIL N7	93	4K	
HOLLAND RPI	913	BRITISH RY	ENGLISH 58B	
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1930

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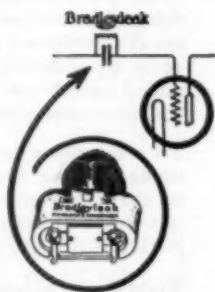
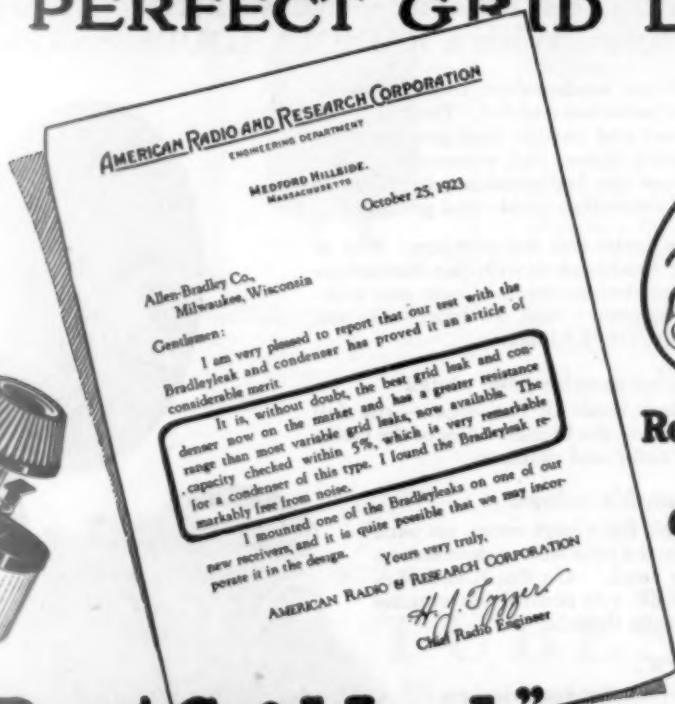
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Telegram	
Day Letter	DL
Night Message	NM
Night Letter	NL

If none of these three symbols appears after the check number of words, this is a telegram. Otherwise its character is indicated by the symbol appearing after the check.

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CLASS OF SERVICE	SYMBOL
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# The Official Organ of the A.R.R.L.

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No. 6

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THE AMERICAN RADIO RELAY LEAGUE, Inc.  
HARTFORD, CONN.

# THE AMERICAN RADIO RELAY LEAGUE

The American Radio Relay League, Inc., is a national non-commercial association of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, for orderly operating, and for the practical improvement of short-wave two-way radio telegraphic communication.

It is an incorporated association without capital stock, chartered under the laws of Connecticut. Its affairs are governed by a board of seventeen Directors, elected every two years by the general membership. The officers, in turn, are elected by the Directors from their number. The League is non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its Board.

"Of, by and for the amateur," it numbers within its ranks practically every worth-while amateur in America and has a history of glorious achievement as the standard bearer in amateur affairs.

Inquiries regarding membership are solicited. Ownership of a transmitting station, while very desirable, is not a prerequisite to membership; a bona-fide interest in amateur radio is the only essential. Correspondence should be addressed to the Secretary.

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# EDITORIALS

## de AMERICAN RADIO RELAY LEAGUE



### Achievement

SEE the gentlemen in the upper right who so convincingly graces our heading illustration? That is supposed to be the editorial We, hard at work dictating inspiration and enthusiasm for the hungry readers of *QST*. The gent looks a whole lot more like the editor of a certain other magazine but let that pass—it's a good picture. There're a few more inaccuracies: our stenographer won't let us chew cigars while talking; besides, we use a dictaphone; and, as our esteemed predecessor once said about a similar heading, we never had a coat and vest like that. But the thing about that picture which is most ruffling to our editorial complacency this morning is the air of easy nonchalance it seems we are to affect as we go about our day's work.

No darn suchything happens! This place is a madhouse about this time of the year. "Hot news" is breaking every day, amateur records are being smashed to smithereens every time we turn around, and it's a wild job to keep up with progress and get the stuff chronicled in the mag. Our amateur activity runs in cycles, you know. During the summer we have little of accomplishment actually to chronicle in *QST*; our pages are filled with informative material and the latest dope on improving amateur operation; everybody is busy studying and rebuilding. Then with the first touch of real winter weather we enter a period of achievement, where that technical progress of the summer is put to use, and, believe us, fellers, things start to commence to happen! A choice bunch of records has been hung up in the month just ended and it's a man-sized job to write *QST* stories and put out newspaper publicity about them and keep the hook clean. In fact there has been such an epidemic of new records in November that our Publicity Manager suggests a schedule be established for them and that hereafter new records be accepted only three times a day! Seriously, though, just contemplate the November slaughter:

(1) Two-way amateur communication across the Atlantic for the first time in history.

(2) New distance records for amateur 100-meter work in that same communication. First 100-meter Transatlantic work by anybody.

(3) New distance record for amateur two-way talk for any amateur power when

WNP worked 6CEU in Hawaii. And 6CEU had but three 5-watters!

(4) All records for length of relays, speed in relaying, and miles per minute, smashed by the 1HX-6ZW-WNP-6ZW-1HX stunts.

(5) Alaska opens up, and 7AHB and 7MN are QSO the States.

(6) Not only do we continue to be heard in Japan and Australasia, but unconfirmed reports indicate two Australian amateur stations have been heard in California!

Isn't it clear that this is truly a period of achievement? How can we keep our editorial coat on and look sweet while we leisurely dictate polished phrases? This old A.R.R.L. is too busy doing things. This month, too, we have our Transatlantic Tests, and we have another bet with friend Burnham, British 2FQ, this time to the effect that at least a dozen European amateurs will be heard in America. A nice clock says they will. (We've cleaned off a place for it on our mantel.)

And now, good people, come back with us to July of 1914 and read an important announcement in *Popular Electricity & Modern Mechanics* for that month:

"An undertaking of great interest to wireless enthusiasts is the American Radio Relay League being organized under the auspices of the Radio Club of Hartford. The object of the league is to establish wireless communication between far distant points thru the co-operation of amateur wireless operators thruout the country. The results of the organization will be unique in that never before has the transmission of intelligence over long distances been possible except thru the agency of some great corporation or the Government.

"It is hoped, within the next two or three months, that a line of communication between Boston and San Francisco will be established and further efforts will be directed toward the establishment of a line from New York to the Mexican border via Washington.

"Owners of stations having a transmitting range of not less than thirty miles are requested to communicate with Clarence D. Tuska, Secretary, Radio Club of Hartford, 136 Oakland Terrace, Hartford, Conn., and it is hoped that all workers who are sincerely interested in the development of wireless telegraphy will lend all the assistance in their power to the consummation of this worthy project."

Oh, boy, the old world do move, and it's a grand winter we have before us! Excelsior!

### What Bothers the B.C.L.

THAT great portion of the American public interested in the reception of broadcast programs is now in the midst of its third season at the game.



Operating conditions have improved vastly. The staggering and zoning of the broadcasting waves eliminated overlapping and did more than anything else could to make the programs enjoyable. At the same time the enforced amateur quiet hours removed entirely the negligible amount of interference caused by amateur operation during the early evening hours. But still the life of a broadcast listener is full of trials, his concerts are broken up just as often and just as completely as before, and his radio existence is not more satisfactory than it was before these improvements came into effect.

The trouble lies with the *commercial traffic*. Even on good selective tuners the interference from shipping and some coastal stations is so bad on the average listener's set, particularly within a few hundred miles of any of our coasts, that reception is anything but a pleasure. These code stations actually use transmitting waves within the broadcast band and so of course there is no simple way of tuning them out. They're not supposed to do it—we thought that American shipping was to be required to forego the use of the 450-meter wave between 7 P.M. and 11 P.M.—but it is worse than ever. We even hear some of our coastal stations *requesting* ships to shift wave from 600 to 450, right into the concert band, to get thru the QRM on 600 meters. Lately we have been making some observations and we find numerous cases where it is impossible to receive broadcasts with any satisfaction whatever, even on fairly selective sets, because of ships pounding in all over the scale—loud powerful signals that break up almost every item on any program. And some of these ships are a thousand miles away.

We amateurs are getting the big end of the blame for this interference, and we don't like it. Our listener friends don't know the code, but if they hear a code signal they are sure it's an amateur. We've even seen several cases where the interfering ship signals were so loud and persistent that the listeners knew just which "local amateur" it was who was breaking up their reception. Now we *know* that the interference we amateurs are causing during quiet hours is practically zero, for the law is being obeyed, and we're getting sick of being blamed for things we don't do. We know by many observations that the B.C.L. has a great big grievance. But that grievance is the commercial interference, not amateur transmission, and we amateurs must pull together to show him the facts. It is the duty of every one of us to point out to our B.C.L. friends that we are co-operating, that we observe the law, that we cause no interference, that this thing that bothers them is an entirely different class of station—we must do this to save ourselves from unjustified blame.

We hope the Bureau of Navigation can find some effective method of dealing with the situation. It is hindering public enjoyment of radio and is bringing upon us amateurs much undeserved criticism.

## Playing Fair

ALL of a sudden there is an awful bunch of fellows recklessly disregarding the radio law in several particulars. How come, gang? You're not "toting fair" with the rest of us—you're liable to get all of us "in dutch."

First there is this matter of wave length. Perhaps it is the rush to get back on the air, thousands of new sets being tested, and at first they are not easy to get down. Whatever it is, there are nights when we hear as many stations above 200 meters as we do below—and our tuner goes away down. We can't expect to get away with anything like this.

Then the "quiet hours." We've just written something about how nicely we observe the quiet hours. In percentages this is true, and we don't think any appreciable interference is caused, but there are too many violations. Slopping over 8 o'clock and opening up a little before 10:30 may be caused by poor time-pieces (for which there is no excuse, by the way) but we refer more particularly to outright transmission in the midst of the quiet hours. The operator who does this violates the regulations as definitely as if he sent a false SOS, and can expect about the same treatment when the Supervisor nabs him—which is only a question of time.

We are even more concerned about the business of false calls. There are not that many "bum fists" in our number, so some of these are deliberate. We have heard unknown stations falsely signing 6KA, 9ZN, 1AW, 1ARP, 9KW, 9RR, 9AOG, 5IA, 1AFV, 7ZU, and 1CBS. What do you think of that, men? Don't you agree with us that it warrants the use of a little "white space" and vitriol in *QST*? Need we say that it is strictly illegal, as well as a rotten trick to play on any station? It may also get the real owner of a call in serious trouble for which he is not to blame. Right there is the point: any man signing another's call must be regarded as trying to transfer the penalty for law violation to the innocent man. It isn't funny, it's serious—and these birds will get short shrift from us, you bet!

Now, what are we going to do about these things, fellows? It is a discouraging job having to write sermons every so often about obeying the law. Your A.R.R.L. Headquarters does it as a service to you, that you and all the rest of us may continue to enjoy amateur radio. Please take it as fair warning, for the time is approach-

ing rapidly when to protect the interests of the big law-abiding majority of amateurs we'll have to unship the Wouff-Hong and go gunning for you. It's plainly evident that a few chronic offenders should not be permitted to get the entire amateur fraternity into trouble. The Bureau of Navigation is not asleep—not by any means. After all the friendly warnings we publish about complying with radio regulations you can't expect A.R.R.L. Headquarters to go on forever pleading leniency for you. We amateurs are not the only radio folks these days, and we have to watch our step. We're entitled to do everything the law permits us, but our strength lies in never transgressing those bounds. The few who pay no attention to regulations are about to be assisted out of amateur radio—they are in immediate danger of losing their licenses. Please take the tip, fellows—play fair.

### This Hoover Cup

ON noon of February 1st the entries will close at A.R.R.L. Headquarters in the competition for the 1923 Department of Commerce Amateur Trophy, more

commonly called the Hoover Cup. This is our last opportunity to remind you of it and to suggest that you get busy on your entry.

This will be the third cup given by Secretary Hoover under the auspices of the League. Its purpose is to encourage individual effort in the design and construction of amateur apparatus—it is emblematic of the high interest the Secretary has in the progress we amateurs are making. It is the highest honor Amateur Radio has to offer in recognition of initiative in short-wave station building. A fine thing about it is that the terms of the award are calculated to reward the builder of "home-made" apparatus, and so the finances of the competitors have little if anything to do with it.

We will hail the winner of this cup as the owner of America's best all-around home-made amateur station for 1923. It's worth real effort to attain. The complete regulations of the contest were published on page 25 of our November issue. Read them carefully, O.M., and file your entry—everybody has a chance.

## Transatlantic Amateur Communication Accomplished!

**1MO and 1XAM Work French 8AB. When Two-Way Amateur Contact is Established Across Ocean for First Time; 1MO Wins QST's Brown Derby for Feat; One Hundred Meters Does the Trick**

THE Atlantic Ocean was bridged in two-way amateur operation for the first time in history when Station 1MO in West Hartford, Conn., communicated for almost two hours on the night of November 17th with French Station 8AB, operated by Leon Deloy in Nice, France. Later that same night Station 1XAM, sometime 1QP, in South Manchester, Conn., also worked 8AB.

For years we have dreamed of this; for over a year we have seen it coming; for weeks we have been sure that winter weather would see the thing accomplished. It has been done, fellows; we are actually in back-and-forth contact with Europe over our amateur sets. For the first time in history we have worked a European amateur, and for the first time the amateurs of distant foreign countries have sat by their respective firesides and talked to each other with ease.

The story of how it was done goes back to this summer when Mr. Deloy, the leading French amateur, visited this country to study American amateur methods with the

avowed intention of "working" us this winter. Hundreds of our fellows met him at the A.R.R.L. Convention in Chicago this fall. Returning home, Deloy applied the "dope" he had collected here and built a short-wave transmitter and when all was in readiness cabled Traffic Manager Schnell that he would transmit on 100 meters from 9 P.M. to 10 P.M. starting Nov. 25th. This news was spread immediately by broadcast and many stations commenced listening. Schnell built a special short-wave tuner for the job and at 9 P.M. on the 25th was tuned to 100 meters and waiting. Promptly at 9 o'clock Deloy started up, and from the very first word he was copied by 1MO. Altho Deloy has been heard in America before, this was in itself an achievement. For an hour he called "ARRL" and sent the cypher group "GSJTP" for identification purposes. The next night, No. 26th, Deloy again transmitted and, having been advised by cable that he was QRK, sent two messages, which were copied not only by 1MO but by 1QP. One of these, the first amateur mes-

sage ever sent from France, read as follows:

NICE FRANCE

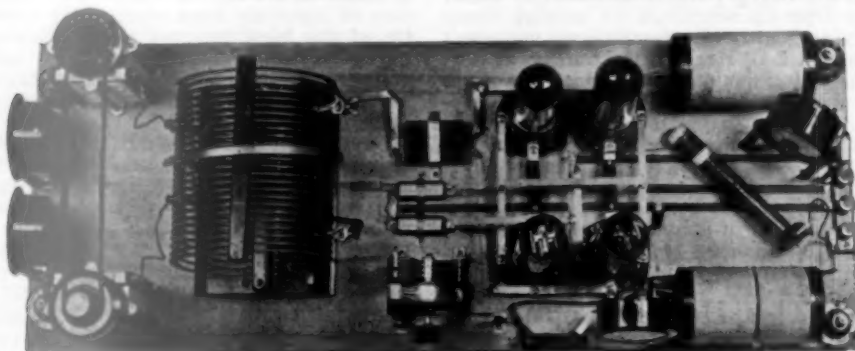
A.R.R.L.

WANT THIS FIRST TRANSATLANTIC MESSAGE TO CONVEY MOST HEARTY GREETINGS OF FRENCH TO AMERICAN AMATEURS.

LEON DELOY

GRATULATIONS THIS IS FINE DAY MIM PSE QSL NR 1 2.

Then Schnell asked him if he would take some messages, and greetings were sent to General Ferrie, director of French military radio, and to Dr. Pierre Corret, president of the French Joint Transatlantic Committee. Meanwhile 1XAM (1QP on special



THE TRANSMITTER AT 1MO-1BHW which, under the call 1MO and on a wavelength of 110 meters, was the first American amateur station to connect with a European amateur. This set was built in accordance with the scheme outlined by John L. Reinartz, of 1QP-1XAM, in another article in this issue, which every transmitting amateur should read.

The other message made a further schedule and proposed listening for a reply on about the same wave. Meanwhile 1MO got permission from the Supervisor of Radio to test on the short wave, and the following night, the 27th, was in readiness. Deloy



1MO And His "Hay-Wire" Receiver With Which He Worked 8AB. (Photo by Foto Topics, Inc.)

came on at 9:30 and for an hour called America and sent two more messages. At 10:30 he signed off, asking for a QSL, 1MO gave him a long call on 110 meters, and European and American amateurs were working for the first time, for Deloy came right back! It brought the thrill that comes but once in a lifetime. Deloy's first words were:

R R QRK UR SIGS QSA VY ONE FOOT FROM PHONES ON GREBE FB OM HEARTY CON-

license) called 8AB on 115 meters simultaneously with 1MO and Deloy acknowledged receipt, asking him to QRX. The Editor took the key at 1MO for a few minutes and exchanged compliments with Deloy, and then Schnell asked 8AB for a message from French amateurs for WNP, the MacMillan Arctic Expedition's "Bow-doin." This message Deloy sent, expressing the hope that they might soon work Mix; but a couple of words were missed at 1MO and a repeat was asked for. Reinartz had copied it solid, however, and acknowledged it to 8AB, who then shifted to his wave and chewed the rag with him for several minutes. Then 1MO and 8AB connected again, Deloy repeated the WNP message to Schnell, but shortly after developed some sort of transmitter trouble and signed off rather hurriedly at 12:28 A.M.

For two hours these two American stations had worked the French station and in this space but one repeat in each country was necessary. At 1MO, 8AB was audible 25 ft. from a loud-speaker working on one audio step, and 1XAM used loud-speaker thruout too. Deloy reported 1MO "a foot from fones," using a Grebe CR-13.

Not only was the ocean spanned but new records were made for 100-meter operation; in fact, we believe we can say it was the short wave that made the accomplishment possible. It is interesting to note that all three stations in this communication used the same circuit arrangement, a Hartley with modification originated by Reinartz and described in detail elsewhere in this

issue. Deloy visited Reinartz while here this past fall and was so interested in the possibilities of the short-wave set that he resolved to build one, with the results already reported.

The next night after this work, Nov. 28th, was a bad one, with plenty of static and noise. 1MO had a schedule with 8AB at midnight; they exchanged calls but that was all. 8AB changed wave length and apparently had trouble. His note was poor and he faded badly. 1BGF in Hartford, listening on a Grebe CR-13, and 1XAM also heard him.

Thanksgiving night, the 29th, 1XAM again worked F8AB for a few minutes. 8AB was right on KDKA's short concert wave, about 103 meters, and could be heard only when KDKA was idling. 1XAM heard him at 8, 8:30 and 9 P.M., and connected with him at 10:40 P.M., asking him to shift wave length. This he apparently did but nothing more was heard of him. 1MO had had a schedule at 6 P.M. but 8AB was not heard.

On the night of Nov. 30th 1MO had 8AB on from 10:58 P.M. until 1:17 A.M., signals very QSA but decent copying utterly impossible because of terrific squeals from several local receivers, to say nothing of heavy static. Four long messages were sent to 8AB and acknowledged. He sent two to 1MO which were copied complete by 1XAM who, fortunately, was free from "listener QRN." 8AB was also heard by 2CQZ, 1BGF, 1ANA, and 1XAQ.

At this writing, the first of the month, a very determined little group of amateurs is hard at the job, resolved that 8AB shall be kept in nightly contact with this country.

#### Schnell Wins the Brown Derby

It is going to be hard to explain to you fellows, we know, how an A.R.R.L. officer happened to win the Brown Derby offered by the Editor of QST as a trophy to the first ham to work to Europe. We hear agonized yells of "Collusion!" We're helpless, tho. Schnell vowed his determination to win the lid, he got busy and did it—and there's nothing else to do, he has won it.

(Jealous of our high British hat, we think, and wanted something to wear himself. Hi!). We're going to hand-paint this derby until O.M. Stetson himself won't know what it is—watch FS's smoke!

#### The Stations

We have no particulars on M. Deloy's transmitter, but imagine his power was close to a kilowatt, for which he is licensed, as he certainly had a mean signal. The note, by the way, is 25-cycle unrectified, and

the signal was strong enough to receive non-oscillating, merely regenerating on the 25-cycle modulation! His receiver is a new short-wave Grebe. 1XAM used the transmitter described elsewhere in this issue, with 3.1 amps. in the antenna on 115 meters; he of course used a Reinartz tuner for reception, with a 2-step. The sender at 1MO is of the same type but is a full-wave self-rectifying circuit using two UV-203-A's on each side of the cycle. The antenna current on 110 meters is about 1.5 amperes. The power at both 1MO and 1XAM is under a half kilowatt. 1MO's receiver was at best a pile of junk, just a couple of cardboard tubes with a few turns of wire in the ordinary tickler circuit, a 4-plate variable condenser, and a junk detector-onestep.

**I**N the first transatlantic operation between U1MO and F8AB, a message of greetings was sent to the renowned General Ferrié, director of French military radio, reading as follows:

HARTFORD, CONN.

GENERAL FERRIE,  
PARIS, FRANCE.

AMERICA GREETES YOU FOR THE  
FIRST TIME BY AMATEUR RADIO  
ACROSS THE ATLANTIC OCEAN ON 100  
METERS.

AMERICAN RADIO RELAY LEAGUE.

The answer was received on the morning of Dec. 2d when F8AB sent his Nr. 9 to U1MO:

PARIS.

AMERICAN RADIO RELAY LEAGUE,  
HARTFORD, CONN.

REMERCE ET MAGNIFIQUES FELICITATIONS  
RESULTATS OBTENUS AVEC ONDE 100 METRES  
QUI ONT PERMIS ETABLIR NOUVELLE LIAISON ENTRE  
FRANCE ET ETATS UNIS.

GENERAL FERRIE.

Translated, this reads:

AMERICAN RADIO RELAY LEAGUE,  
HARTFORD, CONN.

MANY THANKS AND MOST HEARTY  
CONGRATULATIONS ON THE RESULTS  
OBTAINED WITH 100 METER WAVE,  
WHICH HAVE PERMITTED THE ESTABLISHMENT  
OF A NEW BOND BETWEEN FRANCE AND THE UNITED STATES.

GENERAL FERRIE.

Not a thing extraordinary, in other words, about any of the stations—the accomplishment is merely a demonstration, more effective than all our talk, of the efficacy of the



shorter waves. Deloy recognized this too. In his conversation with the Editor via radio he said: "This is... a great moment in my life, for which I have been working several



years. Hearty congratulations to you both and to League for great development of short wave work."

The distance covered by these tests, some 3400 miles, is not remarkable, for western

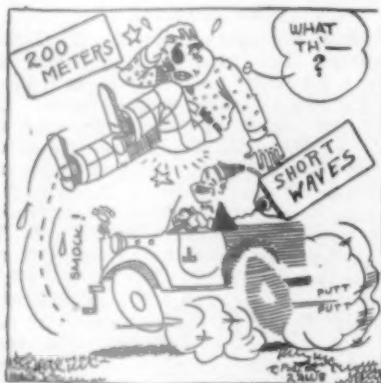
years in that it definitely links us with our European cousins.

### Beating the Tests

It seems assured that this is but the fore-runner of regular transatlantic operation. European amateurs of course continue to log large numbers of American hams regularly. On the night of Nov. 24th 1AWW in Springfield, Mass., and 8BOY and 3BVA at State College, Pa., copied 6NI in Liverpool, England, calling "Test" on D.C.C.W., signals QSA, wave between 225 and 250 meters, 10:20 to 10:30 P.M. E.S.T. Altho we imagine 6NI is a broadcasting station, this was in good Continental. British 2AW and Dutch PA9 solicit special 100-meter tests with American amateurs—the Traffic Manager is arranging schedules. PA9, by the way, is the first authorized amateur transmitter in the Netherlands, especially licensed to the Dutch amateur transatlantic committee at Delft for the 1923-24 tests. There is some activity in Italy and ACD is ready with 200 watts, waiting for his license. Belgium shows signs of life and before long there will be amateur transmitters there. In France and England of course they are ready for us this winter by the dozens, but they will have to step some to keep up with F8AB.

To Deloy and 1MO and 1XAM, our hearty congratulations. You have started a great winter!

—K.B.W.



amateurs dump signals to New Zealand over much vaster distances as a matter of course, nor does it compare with the WNP-6CEU record for two-way communication. But it was over an area confessedly much more difficult to cover, it is the first two-way transoceanic contact with any foreign country, and it is the most important achievement of Amateur Radio in

## Anti-Regenerative Amplification

By Lewis M. Hull, Ph. D.\*

The average radio man is wandering about in a maze of tuned radio-frequency amplifier circuits, bewildered by conflicting claims. Nowhere is the confusion worse than in the field of anti-regeneration devices—those things that are used to keep tuned radio amplifiers from oscillating. The business of this article is to clear up the tangle. It shows that all anti-regeneration devices are built up from a few quite simple ideas, and it explains just how the final circuits work.—Tech. Ed.

**D**URING the past year several different receivers using anti-regenerative radio-frequency amplification have been exploited commercially under different trade names, and the idea has been fostered that these circuits each represent a fundamentally different development in radio technique. As a matter of fact, all vacuum tube repeater circuits, in which regenerative currents through the internal tube capacities are compensated or neutralized by the addition of an extra circuit element, can be separated into a few simple classes. As soon as the basic principles are understood these circuits can be constructed with numerous variations, al-

most to suit the taste of the experimenter. At intervals during the last two years my colleague, Mr. Stuart Ballantine†, and I have investigated a number of anti-regenerative circuits and it is for the purpose of co-ordinating the more popular circuits of this nature with the general scheme of things that the present discussion is written.

### Regeneration

Every operator of a radio receiver knows that tuned amplifier stages are subject to electrical instability caused by regeneration through the tubes themselves, which may produce locally sustained oscillations in one or more of the tuned circuits, with exasperating effect on the ear and disposition of the long-suffering listener. It may be well

\*†Radio Frequency Laboratories, Inc., Boonton, N. J.

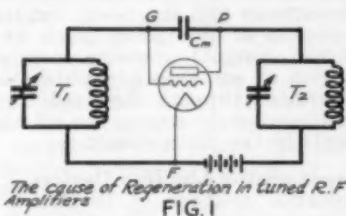


to stop here a moment to recall a few general facts about regeneration. *First, the definition:* Regeneration is any form of reaction from the output (plate) circuit upon the input (grid) circuit of an amplifying tube whereby the alternating-current power supplied to the input circuit is increased. (Obviously regeneration must be preceded by amplification in the tube, or there would be no excess of power available in the output circuit to react.) *Second, the cause:* Among the many ways in which regeneration can be produced, there are two which are especially popular in radio reception; namely inductive coupling from output (plate) circuit back to input (grid) circuit (Armstrong) and capacitive coupling from output back to input. The second (capacitive) method is based on the well-known circuit law that if the output circuit, between plate and B+ terminals, is wholly or partly inductive, any capacity whatever existing between the plate and the grid will pass a reaction current back into the input (grid) circuit which *aids* the current already there. There are two popular methods of controlling this reaction current in regenerative receivers: either connecting an outside variable condenser between plate and grid and varying it to change the magnitude of the reaction ("feedback") path, or using the fixed plate-grid capacity as a reaction path and varying the constants of the output circuit by "tuning" it, or by inserting a series variometer in the plate circuit. It is this latter type of regeneration, produced through the fixed plate-grid capacity by the presence of a tuned output circuit, that we are concerned with in the present discussion of amplifiers.

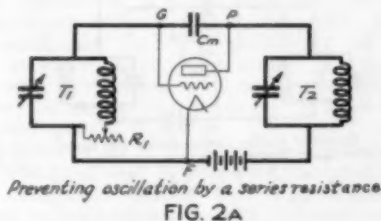
#### Regeneration in Tuned R.F. Amplifiers

Figure 1 is a diagram of the typical tuned amplifier stage which is subject to these regenerative effects.  $T_1$  is the tuned input circuit exciting the grid of the radio amplifier tube and  $T_2$  is the tuned output circuit included in the plate circuit. The stage here shown can be considered the first stage of a series (in which case  $T_1$  would be a tuner and  $T_2$  the primary of a coupling transformer) or it may be an intermediate stage, wherein  $T_1$  and  $T_2$  are respectively the secondary and the primary windings of resonant coupling transformers.  $C_m$  is the other important element, the ever-present mischievous go-between which causes regeneration and instability; in other words  $C_m$  is the internal capacity of the tube itself between the grid and the plate, augmented by the unavoidable capacity between the wiring and other metal parts connected to the plate and grid. These are lumped together and shown on the diagram, Fig. 1, as a single capacity  $C_m$ , which represents the total active feedback-producing capacity of the circuit. The primary (amplifying or forward) action of the amplifier consists of

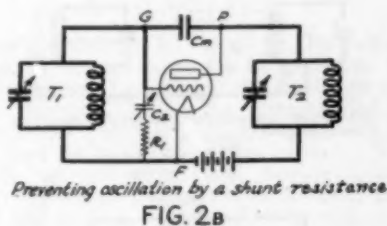
the flow in circuit  $T_2$  of a magnified copy of the currents flowing in  $T_1$ ; this action occurs in the well-known fashion through the agency of the electron streams within the tube. The secondary regenerative or backward action of the amplifier occurs through the agency of the *capacitive coupling* between circuits  $T_1$  and  $T_2$ , which has just been



The Cause of Regeneration in Tuned R.F. Amplifiers  
FIG. 1



Preventing oscillation by a series resistance  
FIG. 2A



Preventing oscillation by a shunt resistance  
FIG. 2B

mentioned. As soon as the magnified currents are established in  $T_2$  by the direct action they react upon  $T_1$  through  $C_m$  and it so happens that when  $T_2$  is tuned even to approximate resonance with  $T_1$ , the secondary currents set up in  $T_1$  by this reaction aid the currents already there.

#### Regeneration Always Present

The question of how far this regeneration is harmful in an amplifier is irrelevant; we are here concerned with the fact that *this regeneration is always present* and even when  $C_m$  is brought down to an irreducible minimum by the use of short connecting leads to grid and plate it may cause spontaneous local oscillations ("howling") and render the amplifier so unstable that it cannot be operated near the resonance point.

#### Purpose of Anti-Regenerative Devices

The function of all anti-regenerative devices is not necessarily complete elimination

of the effects of capacity coupling through  $C_m$  but control of the resulting regeneration such that a cascade amplifier made up of stages like the circuit of Fig. 1 can be rendered stable and easy to tune without producing oscillations in the stages or in the tuner. Many popular circuits on the market today contain two radio-frequency amplifying stages with low-resistance tuned coupling transformers and the novel feature of certain circuits of this class (such as the "neutrodyne" circuit) consists merely of the provision of some agency which limits the regeneration through the fixed  $C_m$  elements of the separate stages, for all tuning adjustments in the plate circuit.

#### Regeneration Limiting Devices

The possible methods of limitation fall into two general classes. The first of these,

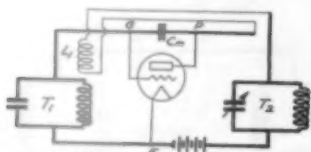


FIG. 3A

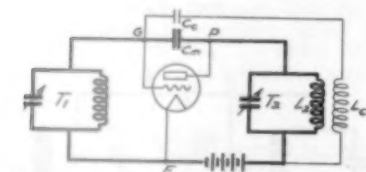


FIG. 3B

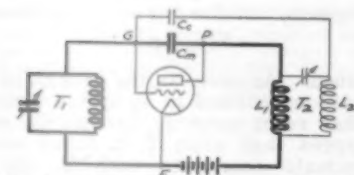


FIG. 3C

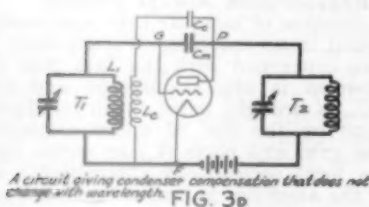


FIG. 3D

dignified not by its merit so much as by its extensive practice, consists of the deliberate introduction of such losses into circuits  $T_1$ ,

$T_2$ , or both, that the energy fed back through the  $C_m$  capacities is thereby absorbed and obscured. Grid potentiometers, "stabilizers," shunt resistances on transformers, transformers wound with high-resistance wire and short-wave transformers with iron cores, are all practical modifications of this ingenious principle. If regeneration were the only activity limited by this method it would have much to recommend it. But it also limits selectivity, tends to produce distortion in the amplified currents and is generally analogous to the custom in the mechanical field of dissipating dearly-bought momentum in the brake linings of a motor car instead of using it to store up energy while the car is being stopped, as is done in certain highly efficient types of electrically driven vehicles. If for practical reasons a method of this class must be employed to control an amplifier the least harmful way of putting it in practice is to introduce a variable series resistance into one of the tuned circuits, as shown at  $R_1$  in Figure 2a, or to use a shunt resistance with a variable inlet condenser, as shown at  $R_1$  and  $C_1$  in Figure 2b.  $R_1$  should have a maximum resistance of about 50 ohms.  $R_1$  should be considerably larger. If  $R_1$  is about 50,000 ohms a two-plate "vernier" condenser can be used at  $C_1$ . In either case, since the losses are controllable, the absorption of regenerated currents is variable, and the control does not involve inter-stage rectification as is frequently the case when the grid is biased by a potentiometer connection between the legs of the filament. The latter device also is practically equivalent to replacing a variable shunt resistance across circuit  $T_1$  since the grid-filament path through the tube draws more and more current as the mean grid voltage is increased above that of the negative filament terminal by a potentiometer. The disadvantage of this method lies in the distortion produced by the changing grid-filament resistance of the tube.

#### Feedback Prevention and Compensation

The second general class of methods of control strikes at the source of the regenerative feedback and involves either the prevention of current flow through the capacity  $C_m$  or the compensation of the effects upon the input circuit of this current flow. This class of methods falls into two groups. In the first of these, exemplified by the Hazeltine "Neutrodyne" circuit, the degree of compensation is progressive, increasing as a suitable variation is made in the compensating element, so that over-compensation is possible, with a corresponding reduction in the effective amplification of the circuit below that furnished by the forward action of the tube alone. In the second, of which the Rice circuit is an example (described in U. S. Patent No. 1,334,118) the compensation can be in-

creased only to a critical or maximum value which just obscures the reaction through  $C_m$  and then is reduced again, during a progressive change in the compensating element.

#### Reversed Tickler

The simplest method of the first group is shown in Fig. 3a. It consists merely of the addition to the  $C_m$  coupling between grid and plate circuits of an additional magnetic coupling through the coil  $L_1$ . The connections to this coil are made opposite (reversed) with respect to those of the feedback coil in the Armstrong circuit, so that this magnetic coupling tends to suppress regeneration instead of aiding it, thus directly opposing the coupling through  $C_m$ . This circuit has been used by many experimenters and was probably first disclosed by Hartley (U.S. patent No. 1,183,875). It is now being utilized commercially in the Tuska "Superdyne" receiver. An inherent disadvantage of this form of control is that it involves balancing an inductance against capacity and hence the degree of compensation varies quite rapidly with the wavelength of the received signal. A fixed value for the inductive coupling may prevent actual self-oscillation over a band of wavelengths, but in general as  $T_1$  and  $T_2$  are tuned to different wavelengths the compensator coupling must be changed as well.

#### Reversed Capacitive Feedback

In the second circuit of this group (shown in Fig. 3b) the compensating element is a condenser  $C_c$  connected from the grid to the high-potential terminal of a coil  $L_2$ , which is so coupled to the primary coil in the tuned plate circuit that the voltage across  $L_2$  is just opposite in phase and bears a constant ratio to the voltage across circuit  $T_2$ , regardless of the wavelength to which  $T_2$  is tuned. Hence by proper choice of  $C_c$  the current through  $C_c$  can be made to introduce into  $T_1$  a voltage which opposes and just balances that produced by the current through  $C_m$ . This is Professor Hazeltine's circuit. It should be noted that if the coefficient of magnetic coupling between coils  $L_2$  and  $L_1$  could be brought fully up to unity, and if the capacitive coupling between these two coils could be simultaneously kept low, the feedback currents from  $T_1$  into  $T_2$  would be prevented *equally at all wavelengths*; the neutralization would be truly independent of the frequency and of the tuning of  $T_2$ , as specified in Professor Hazeltine's original disclosures. It is an unfortunate physical fact, however, that two coils cannot be wound in opposite directions, with a reasonably low intercoil capacity, without allowing appreciable magnetic leakage between them. This causes the voltage across the secondary coil  $L_2$  to depart somewhat from a uniform and constant opposition to the voltage across the primary coil; the relative phases are made to depend

somewhat upon the frequency. *This is the reason why the degree of compensation varies to some extent with the tuning in the commercial neutrodyne sets.* The only way in which two air-core coils can be given approximately unity coupling is to wind the two wires which compose the coils together, so that they go on the coil support in the form of geometrically parallel strands. This cannot be done with the neutrodyne coils because the sense of the windings must be opposing, and it is impossible to reverse one coil after winding them together on account of the high distributed capacity between them. This structural difficulty appears to be a permanent bar to the full enjoyment of the theoretical advantages of this excellent circuit.

A somewhat similar type of circuit is shown in Fig. 3c. Here the coupling unit which joins the tube shown to the next in line consists of a *series resonance circuit*, comprising coils  $L_1$  and  $L_2$  in series, tuned by condenser  $C_1$ . The coils may or may not have mutual inductance; it is immaterial for purposes of compensation, but it may be convenient in tuning to have them coupled *loosely* together. The coil  $L_1$  is in the plate circuit of the amplifier tube shown, and the grid and filament of the next tube are connected across  $L_2$ . The circuit is tuned to resonance with the incoming wavelength,  $\lambda$ , by so adjusting  $C_1$  that

$$\lambda = 2\pi \sqrt{(L_1 + L_2 + LM) C_1}$$

When the circuit is resonant the voltage across  $L_2$  is just opposite in phase to the voltage across  $L_1$ . Hence the feedback currents through  $C_m$  can be compensated by connecting  $C_c$  between the top of  $L_1$  and the grid, just as in the Hazeltine circuit. This circuit has the advantage, moreover, that the grid voltage passed on to the next tube bears the ratio  $L_2/L_1$  to the plate voltage of the tube shown, at resonance, whereas with transformer coupling, as in circuit (b) these voltages are in the ratio  $\sqrt{L_2/L_1}$ . In other words, this circuit "steps up" the voltage at resonance as the *square* of the turn ratio, instead of as the first power of the turn ratio with ordinary transformer couplings. The circuit has the peculiarity that while compensation of regeneration is not perfect for wavelengths off the resonance point of the coupling circuit, the compensation at resonance is independent of the resonance wavelength. I have constructed two-stage radio-frequency amplifiers using this circuit which were very successful.

#### A Good Circuit

In circuit 3d the compensating element contains a coil  $L_c$  closely coupled to the tuned input circuit,  $T_1$  as in circuit 3a. Circuit 3d has two important advantages, however; First, the plate circuit proper does not contain the compensating element, and second, the

compensation can be fixed, independent of the wavelength, over a wide range. In a single stage as shown here the output transformer or coupling  $T_2$  may have any form whatever since it has no connection with the compensator. The tuned input circuit must contain a coil  $L_1$  and coupled to this coil with very close coupling (coefficient of coupling greater than 0.5 and preferably nearly unity) is the compensating coil  $L_c$  which is wound in the sense opposing  $L_1$ . The high side of  $L_c$  is connected to the plate through a condenser  $C_c$ , so chosen, as in all the other circuits, that the back voltage from the plate acting through  $C_c$  and  $L_c$  upon circuit  $T_1$  will just balance the back voltage from the plate acting through  $C_m$  upon circuit  $T_2$ . The adjustment of  $C_c$  is rather critical, but the circuit is useful because one or two stages can be controlled without oscillation, with the compensator in the tuner alone. For instance circuit  $T_1$  can constitute a single-circuit tuner directly in the antenna, with compensating coil and condenser  $L_c$  and  $C_c$  (which perform independent of the load in the plate circuit). Then  $T_2$  can be any form of radio-frequency transformer working into a detector or into another amplifier stage. In fact I have operated two R.F. stages into a tube detector from such a compensated tuner, with Ballantine Variotransformers, Model 5, as the coupling elements in both stages, with entire freedom from oscillation over the range from 150 to 600 meters. The compensation prevents oscillation in the tuner, which is where the most noisy and disagreeable oscillations occur, and with this model of Variotransformer no oscillations are produced in the transformers themselves. The condition for a compensation which is independent of the wavelength in this circuit is as follows:

$$C_c/C_m = L_1/M = \sqrt{\frac{L_1}{L_c}} = \frac{N_1}{N_c}$$

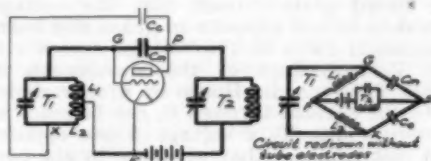
where  $M$  is the mutual inductance between  $L_1$  and  $L_c$  and  $N_1$  and  $N_c$  are the numbers of turns, respectively, in coils  $L_1$  and  $L_c$ . Thus, when the turn ratio is determined, the value of  $C_c$  for complete suppression of regenerative effects depends, as in the Hazeltine circuit, only upon the grid plate capacity,  $C_m$ .

#### Wheatstone Bridge Circuits

The second group of methods in which over-compensation is impossible is easy to describe but not simple to put in practice. The principle employed is the following property of the alternating-current Wheatstone bridge: If a bridge be arranged with four arms, which may be capacities, inductances or resistances, and the bridge is properly balanced, then an alternating voltage impressed between either pair of opposite points of the bridge can produce no

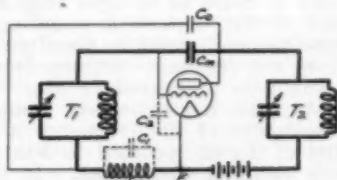
voltage drop between the other pair of opposite points of the bridge. In other words, a balanced bridge is a network in which two spaced points are electrically isolated from two other points. Reference to Fig. 1 suggests the utility of this principle in opposing regeneration. In order to prevent regeneration the input circuit  $T_1$  must be electrically isolated from the output circuit  $T_2$ , except for the "forward action" of the amplifier tube. This is done by forming four external arms of a balanced bridge and placing the input and output circuits across the two pairs of opposite terminals of this bridge.

Figure 4a illustrates an application of the principle in the Rice circuit. The filament terminal of the tube, instead of being connected to the lower end of the input circuit  $T_1$ , is connected to an intermediate point which divides the inductance of this circuit into two parts,  $L_1$  and  $L_2$ . The lower terminal of the input circuit is connected through a small fixed condenser  $C_c$  to the plate. Then terminals  $G$  and  $X$  of the input circuit and terminals  $P$  and  $F$  of the output circuit are two pairs of opposite points of a Wheatstone bridge having two inductive arms and two capacitive arms. The inductive arms are  $L_1$  and  $L_2$  which serve also as elements of the tuned input circuit  $T_1$ . The capacitive arms are  $C_c$  and  $C_m$ . The bridge is balanced for a given magnitude of capacity  $C_m$  by so placing the filament tap that inductance  $L_1$  bears the ratio to  $L_2$  that capacity  $C_c$  bears to  $C_m$ . Thus if  $C_c$  is made equal to  $C_m$  the filament connection can be brought permanently to



A Wheatstone Bridge Method - The "Rice Circuit"

FIG. 4a



Another Wheatstone Bridge method

FIG. 4b

the center of the inductance coil in  $T_1$ . It is best in constructing this circuit to connect the filament lead permanently near the center of the coil and vary  $C_c$  until a balance is reached.  $C_c$  can then be locked. The



proper value of  $C_c$  will seldom be greater than 15 micro-microfarads. When the bridge is balanced in this way  $T_1$  is electrically isolated from  $T_2$  since all retroactive currents through  $C_m$  are exactly compensated in  $T_1$  by opposing currents through  $C_c$ . This permanent compensation is independent of the wavelength and of the tuning of circuits  $T_1$  and  $T_2$  when the bridge is balanced. It is also independent of the internal resistance and amplification factor of the tube, provided that no grid current flows in the tube. The amplifying action of the tube is the same as before. When a received signal is brought into  $T_1$ , the resulting voltage across the  $L_1$  portion of the coil is impressed on the grid and a magnified copy of the currents in  $T_1$  is maintained by the tube in  $T_2$ . The tube is now a true one-way repeater, however, and no reaction by these currents upon  $T_1$  is possible. Amplifiers with four or five cascaded stages can be constructed in this way which will be perfectly stable and easy to manipulate. The input tuner and the secondaries of the radio-frequency transformers need only to be supplied with a center tap and each stage must be provided with a compensating condenser as shown in the figure. Any experimenter who has had experience with a radio-frequency bridge will realize, however, that the circuit must be arranged with regard for stray capacity couplings.

A second compensated circuit of this type is shown in Fig. 4b. Here the arms of the Wheatstone bridge are all capacitive.  $C_c$  is an external fixed condenser, forming the arm adjacent to  $C_m$ .  $L$  is a radio-frequency choke coil of such size that its distributed capacity  $C_i$  serves as a fixed bypass for radio frequency currents.  $C_1$  is the third arm of the bridge and  $C_2$  the fourth arm.  $C_2$  may be an external condenser but it is convenient to use for  $C_2$  merely the internal capacity of the tube between grid and filament, hitherto unmentioned. Thus the only extra circuit elements that are necessary are the fixed coil  $L$  and the condenser  $C_c$  which can be adjusted and then set.

Similar other combinations of inductance with capacity and resistance with capacity in the four arms of the bridge are possible, all of which permit a balance which is independent of the frequency. Those previously shown are typical and perhaps the most practicable. For economy of apparatus two of the arms should be arranged as parts of the tuned input circuit whenever possible.

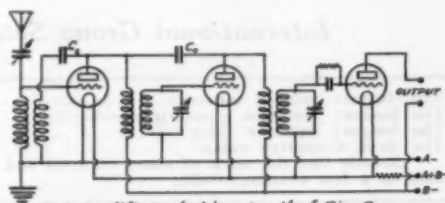
#### Complete Amplifier Diagrams

In Fig. 5 are shown circuit diagrams for two two-stage anti-regenerative amplifiers using two of the circuits previously described. These are shown merely to demonstrate how the typical single stage pictured in the diagrams can be cascaded. There

are no points of novelty in the coupling transformers or the compensating condensers. Either of these circuits when carefully constructed with two or three stages will equal any other anti-regenerative circuit in stability, selectivity and quality of the detected signal.

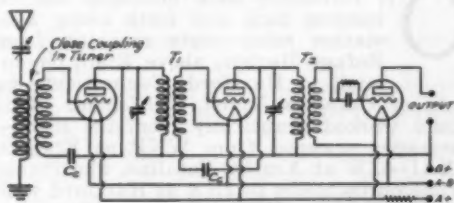
#### History

In this somewhat hurried review of the situation existing today I have made no ref-



R.F. Amplifier embedding circuit of Fig. 3a

FIG. 5A



R.F. Amplifier embedding modification of circuit of Fig. 4a

FIG. 5B

ference to some interesting historical aspects of anti-regenerative amplifiers. Regeneration in tuned amplifiers only has been considered because this type is of prime importance at the present time. The somewhat more complicated problems of regeneration in resistance-coupled amplifiers were attacked and partially solved by the French army engineers years ago, at a time when they used such amplifiers extensively. The first "reflex" circuit which appeared in this country was contained in a resistance-coupled amplifier brought over by General Ferrié in 1917, which also contained means for controlling regeneration in the form of a variable capacitive coupling between the output of one stage and the input of a previous stage, so positioned in the series that the voltage in these two circuits conspired through this coupling to oppose regeneration. The importance of anti-regenerative devices was appreciated some time ago by Nichols, who described an external anti-resonant grid-plate coupling (U.S. patent No. 1,325,879) and by Heising, who published extensive information on the incomplete control gained in a single stage by varying the constants of the output circuit (U.S. Patent No. 1,426,733). These patent references, as well as the others cited in this paper constitute, as far



as I am aware, the only published accounts of the contributions of these experimenters.

It should be mentioned here that important contributions to the design of anti-regenerative amplifiers were made by Balantine as far back as 1918 of which no published description was ever made. He

first applied the principle of the alternating current Wheatstone Bridge in isolating the output circuit of an amplifier from the input circuit, and pointed out extensive applications of this principle in particular circuits, some of which are in use at the present time.

## New World's Relay Records

*International Group Sets Speed and Distance Marks*

The fastest relayed message.....	2412 miles per minute.
The longest 3-station round-trip relay.....	12,300 miles.
The longest amateur relay.....	9,565 miles.
The first 4-country relay.....	France, U.S.A., Canada, Greenland.
Sounds like the work of many stations and many weeks, doesn't it? But it isn't—6 stations did this in a few evenings.—Ed.	

ON November 20th messages started buzzing back and forth along a 3-station relay route reaching from Refuge Harbor, above Etah, Greenland, to Hartford, Connecticut—by way of Catalina Island, California. This route worked beautifully from the start—messages snapped from WNP at Etah to 6XAD-6ZW at Avalon, Catalina, and thence transcontinentally to 1HX at Hartford with hardly an interruption. After the route had run for about a week and had provided

another try that evening, and while they did not better this speed they put a message (a thanksgiving greeting from Mrs. Mix) into Don's snowed-under radio cabin less than 6 minutes after his mother had finished telephoning it to 1HX.

### The Speed Record

On the next night the new record was made—a message started at 1HX at 5:19:00 A.M. Eastern Standard Time, was acknowledged by 6XAD at 5:21:00 A.M. E.S.T. and after a "break" to WNP was acknowledged by that station. Immediately Mix started an answer back to 6XAD, who acknowledged with a single "R," broke to 1HX and received an acknowledgment at 5:24:06 A.M. E.S.T., or FIVE MINUTES AND SIX SECONDS AFTER THE MESSAGE HAD STARTED. This represents a distance of 12,280 miles covered at the rate of 2412 miles per minute. That's a double world's record, the longest round-trip relay and the fastest relayed message!! It beats the famous 1AW-9AWM-6ZAC message in both respects, for that covered 9800 miles at a speed of 2279 miles per minute.

This was a good beginning but there was more to come—and on the same night at that.

### The International Relay

In the early morning of the 27th 1MO and 1XAM-1QP were working French 8AB at Nice, France. Presently Leon Deloy of "F8AB" sent 1MO a message addressed to WNP and the message was copied partly by 1MO, but copied complete and acknowledged by 1XAM who phoned it to 1HX. From 1HX the message went to 6XAD as usual but stalled there since WNP was apparently not on the air. 6XAD gave it to Canadian 9BP at Prince Rupert, B. C., who passed it to WNP the next night. This message broke no speed records—it hardly traveled fast at all but it did break two



"Four on One Hook!"

rapid contact between Radioman Donald Mix, 700 miles from the north pole, and his family at Bristol, Conn., it happened to occur to both 6XAD-6ZW and 1HX that they had all the machinery for making a round-trip relay speed record. They began trying on the 27th and made a round trip in 8 minutes and 30 seconds for 12,300 miles covered. This was good—but it needed improvement to suit these three. They took

other records: it was the first 4-country relayed message, and it traveled farther than any relayed amateur message had ever gone before.

Here is the routing:

	Miles
F8AB, Nice, France to 1XAM, S. Manchester, Conn.....	3500
1XAM to 1HX by telephone	
1HX, Hartford, Conn., to 6XAD-6ZW, Avalon, Cal. ....	2500
6XAD-6ZW, Avalon, Cal., to Can. 9BP, Prince Rupert, B. C. ....	1305
Can. 9BP, Prince Rupert, B.C. to WNP, Etah, Greenland.....	2260
Total.....	9565

#### The Stations That Did It

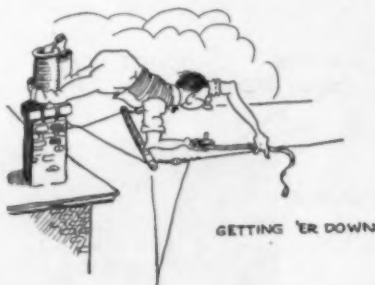
WNP has been described many times in these pages. Mix, the 50-watt tubes and the Zenith sending set, performed brilliantly as always. Wave length 180 meters. Receiving set, Zenith 1R.

9BP, Jack Barnsley's station at Prince Rupert, B. C., has acquired fame along with WNP. The description on page 49 of the December issue is still good, except that this time the wave was 180 meters. Paragon receiving set.

6XAD-6ZW, Lawrence M. Mott's station on Catalina Island, Calif., certainly needs no introduction—it has been heard everywhere. We do not know which of the many sending sets was in use but the signal on this coast sounded as if the antenna cur-

rent was about 15 amperes. Wave 220 meters. Grebe CR-13 receiver.

1HX-1XAQ used a pair of "50-watt" General Electric UV-203-A tubes in the familiar Hartley circuit—with A.C. on the plates, one tube on each side of the cycle. Nothing remarkable about this set except an 85-foot mast that nearly caused this magazine to need a new technical editor—and the C. D. Tuska Co. a new Engineer.



"Every Station but 6XAD-6ZW was below 200"

It happens that the station belongs to "LQ" and to "BP." Wave 180 meters. Tuska 220 receiver.

1XAM is described in this issue. Wave 100 meters. Reinartz receiver of course.

That leaves French 8AB, of which station we know little except that it belongs to Leon Deloy of Nice, France, and that the plate supply sounds like about 20 cycles—rattles. But it has plenty of punch, even tho the wave is 100 meters. Grebe CR-13 receiver.

## A Constant Frequency Set With a Record

By Captain Tom C. Rives, Signal Corps, U. S. A.\*

The first requirement made of an amateur set is range. The set at 2CXL meets that requirement gloriously, for it has been copied daily, with a single tube, by Mr. John L. Liestra at Rotterdam, Holland. What else is demanded of the ideal amateur set? Probably that it is reliable, simple, efficient, able to send out a steady, sharp wave without keying clicks and—not too expensive. Then if the set can shift wave rapidly it is surely a very good set. The set at 2CXL meets all these hard requirements.—Tech. Ed.

THE set described here was designed and constructed in the Radio Department of the Signal School at Camp Alfred Vail, New Jersey, by enlisted students in the school. Much valuable information as to design data was obtained from Mr. Pressley and Mr. Young of the Radio Laboratories at this place. The present set is only a table hook-up but we hope some day to mount it on a panel. The set was started at about the

same time that QST started fighting for a band of wavelengths for the amateur instead of just the one fixed wave length. It took about three months of experimenting with different hookups before we got anything worth while.

The set uses a constant-frequency master oscillator of the Hartley type, the output of this master being amplified by three tubes (power amplifier) before being fed to the antenna. By means of a variable condenser it is possible to vary the wave length of the master oscillator circuit from 170 meters to 200 meters. The antenna circuit

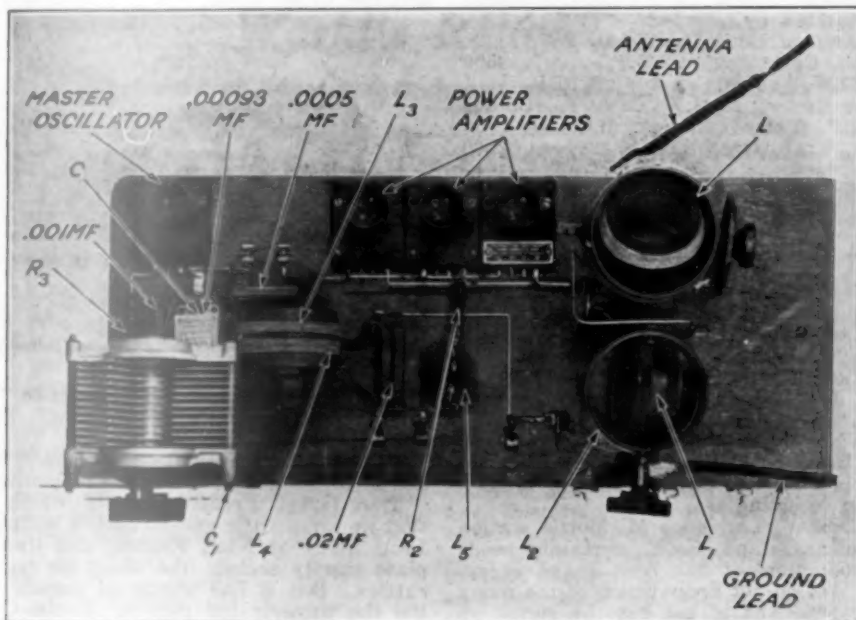
\*Radio Station 2CXL, Signal School, Camp Alfred Vail, N. J.

is brought into resonance by means of a variometer or a variable condenser, depending entirely upon whether the antenna wave length is above or below the wave it is desired to emit. A change from one wave to another takes about 30 seconds.

### The Master Oscillator

The master oscillator inductances  $L_1$  and

Radio one with a maximum capacity of .0005 microfarads and a minimum capacity of about .00001 microfarads. To secure good operation of the master oscillator it was necessary to move this entire capacity-range upward by adding the fixed condenser C. This gave a combination with a maximum capacity of .00143 and a minimum of .00094 microfarads. This fixed conden-



THE MASTER-OSCILLATOR SET AT 2CXL

$L_1$  are wound on a tube  $3\frac{1}{2}$ " outside diameter. The full details of these inductances are shown in Figure 2. While "Litz" was used in our set we found that No. 10 D.C.C. magnet wire worked very well for

ser was made of small sheets of mica .01" thick, placed between leaves of sheet brass having the dimensions shown in the drawing. Two of the brass leaves and the outside metal clamping plates were connected together as one terminal of the condenser, while three other brass leaves were connected together for the remaining terminal. The capacity of the condenser, when clamped together by means of 4-32 machine screws, as indicated in Figure 2, was .00093 microfarad. The dimensions of the parts are also given in Figure 2.

The resistance  $R_1$  is a 12,000-ohm grid-leak. The coil  $L_4$  is a radio-frequency choke made by winding approximately 3000 turns of No. 33 D.S.C. wire in the  $\frac{1}{2}$ "x $\frac{1}{2}$ " space of the fibre (or wooden) spool shown in Figure 2. These two units make up the grid-leak of the master oscillator.

All of the condensers in the set except C and  $C_1$  are Dubilier type 557 and they easily stand 500 volts without breaking down.

### The Amplifier

After the master oscillator is completed and in good operating order, connect it

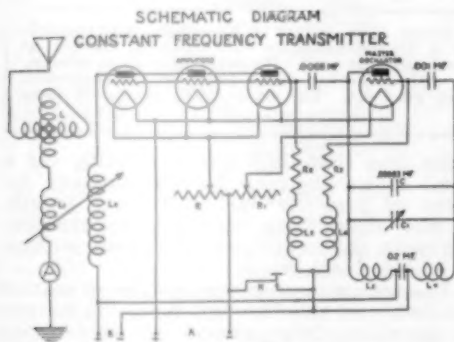


FIGURE 1

these inductances, also for coils  $L$  and  $L_1$ . Don't waste time or money on the Litz.

The variable condenser  $C_1$  was a General

to not over three<sup>1</sup> amplifier tubes as shown in Figure 1 and 2. When using three VT-2 or "E" tubes the grid-leak  $R_1$  has a value of 5,000 ohms and is of the same type as  $R_2$ , while the choke  $L_3$  is exactly like  $L_4$ , described before.

The primary of the output transformer,  $L_5$ , is made by winding about 40 turns of No. 26 D.C.C. wire on a 4-inch tube as shown in Figure 2. Connect this winding into the plate circuit of the amplifiers tubes (in series with the milli-ammeter) as shown in Figure 1, and start the set going. Leave the antenna circuit open. Set the variable condenser  $C_1$  at the middle of its range and read the milli-ammeter; it will probably read very high. Now take one turn at a time off the winding  $L_5$  until the milliammeter reading comes down to very nearly zero. We got this reading down to about 12 mils. with full voltage on the tubes. This is supposed to determine the most efficient number of turns for this winding.

Figure 4 shows the curves that were made while determining the correct number of turns for the primary ( $L_5$ ) of the output transformer. Since we desired to work well below 200 meters the 29-turn coil was selected as it gave the lowest

will be used under ordinary conditions. (Under no circumstances attempt to make this adjustment with the antenna circuit closed and with the antenna ammeter as the indicator. The result of such an attempt will certainly be that the am-

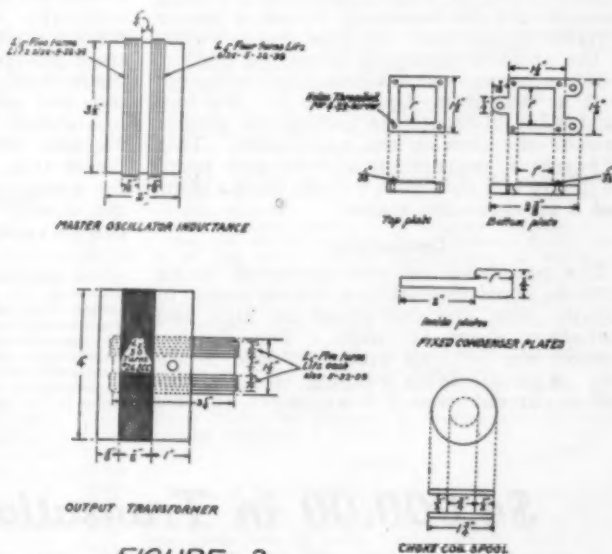


FIGURE 2

plifier will oscillate and not be controlled by the master-oscillator. Follow the method given by the author, remembering that his results fit only his particular tubes and antenna. If you wish to work over a wider band of waves, tap  $L_5$  at several turns and use a clip. Thus it can be seen from Figure

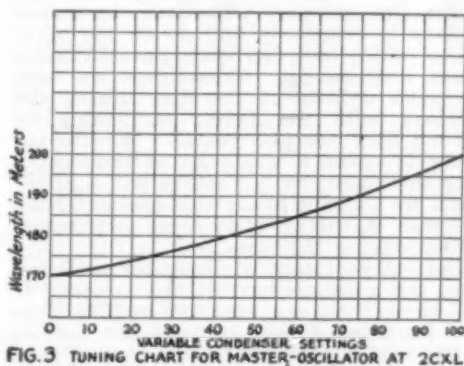


FIG.3 TUNING CHART FOR MASTER-OSCILLATOR AT 2CXL

input at these wave lengths. The correct coil for each band of wave lengths is the one whose lowest point is at about the center of the band of wave lengths which

<sup>1</sup>—This is a thing that causes many master-oscillator sets to fail. The rating of the amplifier tubes must not be over about 3 times that of the master tube if steady and reliable operation is wanted. Don't try to operate a pair of 50-watt tubes on a 5-watt master.—Tech. Ed.

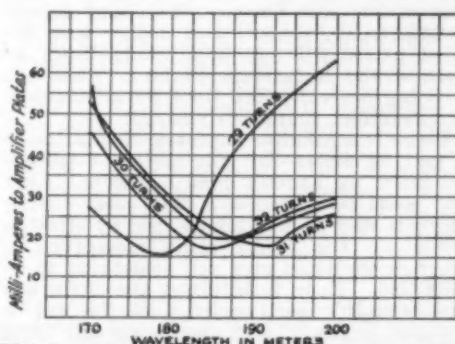


FIG.4 CHART SHOWING METHOD OF ADJUSTING AMPLIFIER PLATE COIL AT 2CXL

4 that at 2CXL the following taps would be useful for ordinary amateur work: 28 turns—Below 170 meters; 29 turns—170-182 meters; 30 turns—182-189 meters; 31 turns—189-200 meters.—Tech. Ed.)



### The Antenna Circuit

The secondary,  $L_2$ , of the output transformer is wound with Litz as shown in Figure 2, but here again a solid D.C.C. wire will serve well. If the wave length of the antenna, with  $L_1$  connected in the antenna lead, is higher than the working wave it will be necessary to use a series variable condenser. If the wave length of the antenna system is below the desired working wave an antenna variometer is used as shown at  $L_1$ , Figure 1. We had quite a bit of trouble in getting the proper number of turns on the variometer. This is purely a proposition of "cut and try;" we finally left ours with 8 turns on the rotor and 8 turns on the stator.<sup>2</sup>

### Operation

The completed set was connected to an antenna consisting of two 4-inch cages in parallel with one end about 30' high and the other about 50' high. The flat-top portion was 50' long with a 30'-lead to the set. With all tubes running cool the antenna current was 2.6 amperes at 200

meters and about 2.3 amperes at 170 meters.

It is a pleasure to work the set as it is a sure-fire proposition, and with D.C. on filaments and plates gives a beautiful C.W. note. The only kick we have heard against it is that it is too sharp. Once we raise a man he can stay with us but it doesn't ordinarily disturb the ether enough to attract attention. The combination of constant frequency plus inductive coupling to the antenna certainly eliminates interference and gives a very sharp wave.

Although the constants of this set are for use with Army VT-2 tubes, it is believed that they will not be very far off for commercial 5-watt tubes. At any rate, the circuit has been found to be all that can be expected of it.

<sup>2</sup>—A simpler construction would be to wind extra turns on  $L_1$  which could be made to slide in  $L_2$  rather than turning as at present. To change wave one would then move the antenna clip and turn the master-oscillator condenser until the antenna ammeter went up again. The losses in such an arrangement would perhaps be lower than in a series variometer. Where a series condenser is needed there is no object in tapping  $L_1$ .—Tech. Ed.

## \$4,000.00 in Transatlantic Prizes

By F. H. Schnell, Traffic Manager

FOUR thousand dollars is the value of the prizes donated to us amateurs by our many good manufacturers, jobbers, and dealers of the United States for our Fourth Transatlantic Tests. The A.R.R.L. wishes to acknowledge with heartiest thanks the splendid response and keen co-operation in the interest of our Tests. We hope every manufacturer, jobber, and dealer who donated prizes will get back many times as much as he is putting in from what advertising we can offer thru these columns. Our heartiest thanks to you all!

There is a peculiar aspect to this business of getting prizes for this series of tests—you know we haven't done it before. Last year some of us couldn't keep quiet during the tests and we had hoped that by offering prizes of the finest radio apparatus in America we could give you something to be quiet for. Ever hear about the little boy who wouldn't keep quiet until he got a piece of candy? Well, we're not all little boys but we have something to offer you if you will keep your transmitter silent and do some good receiving of European amateur signals during the tests. Another reason why we went after prizes is because we think this will be "the last of the Trans-Atlantics," because two-way Transatlantic Amateur Communication has

been established and there is no necessity of another series of tests.

Believe yours truly, it is no easy matter to sort our \$4000.00 worth of prizes in a way that will be satisfactory to everybody and do all the other things which come up when Trans-Atlantic Tests come along. (Next year we hope to spend a little of the time during the holidays with the family—something we haven't done for two years.) We are not going to spend a whole lot of time going over the conditions of "how to win a prize"—but we do want to say that the way NOT TO WIN A PRIZE is by using your transmitter during the tests.

Get out your copy of December QST and read the announcement of the contest. If you haven't got one, send 20¢ to 1045 Main St., Hartford, Conn., and get one. (You might send a \$2.00 bill and be sure of your copies for twelve months in the future.) December QST will give you all you have to know about the prizes and how to win them.

The three judges, whose duty it will be to verify and approve all reception records, are K. B. Warner, Secretary A.R.R.L. and editor of QST; A. A. Hebert, treasurer, A.R.R.L.; and F. H. Schnell, traffic Manager, A.R.R.L.

In the event that no signals are heard,



all prizes will be returned to the donor, as will all prizes not qualified for. The prizes are not at A.R.R.L. Headquarters; they are being held pending shipping instructions from A.R.R.L. upon verification of reception reports and proof of NO TRANSMISSION. What shall we ship you, OM?

In submitting your reception report show all details, including your name and complete address. Your log must show date, time (be sure to specify whether you use eastern standard or Greenwich time), call and/or code word. You know what is wanted—let us have it!

#### VALUE OF PRIZES OFFERED

A. H. Grebe & Co., Richmond Hill, N. Y.	\$1100.00
Howard Radio Co., Chicago	200.00
C. D. Tuska Co., Hartford, Conn.	200.00
Chicago Radio Laboratory, Chicago	160.00
Zenith Radio Corporation, Chicago	160.00
Adams-Morgan Co., Upper Montclair, N. J.	140.00
The Magnavox Co., Oakland, Calif.	135.00
Colin B. Kennedy Corp'n, St. Louis	125.00
Multiple Electric Products Co., Newark	125.00
Bakelite Corporation, New York City	100.00
Nathaniel Baldwin, Inc., Salt Lake City, Utah	100.00
Premier Electric Co., Chicago	99.00
Radio Corporation of America, New York City	81.50
National Chelsea Radio Corporation, Boston	57.20
Crosley Manufacturing Co., Cincinnati	55.00
Klaus Radio & Electric Co., Eureka, Ill.	55.00
Burgess Battery Co., Madison, Wis.	50.25
The Precision Equipment Co., Cincinnati	50.00
R. Mitchell and Co., Boston	49.00
National Carbon Co., Long Island City, N. Y.	48.15
Electric Specialty Co., Stamford, Conn.	48.00
Tresco, Davenport, Iowa	47.50
Rieger Research Corporation, New York City	45.85
E. T. Cunningham, Inc., San Francisco	39.00
Tower Manufacturing Corp'n, Boston	35.40
Allen-Bradley Co., Milwaukee, Wis.	33.80
Dubilier Condenser & Radio Corporation, New York City	32.85
Chas. A. Branstetter, Inc., Buffalo	32.00
Maxim Silencer Co., Hartford	31.50
Unity Manufacturing Co., Chicago	30.60
Horne Electric & Mfg. Co., Jersey City, N. J.	30.00
Thordarson Electric Mfg. Co., Chicago	30.00
General Radio Co., Cambridge, Mass.	29.25
Coto-Coil, Providence, R. I.	28.75
Jewell Electrical Instrument Co., Chicago	25.00
Stromberg-Carlson Mfg. Co., Rochester	23.00
Kimley Electric Co., Buffalo	22.50
Newman-Stern Co., Cleveland	19.50
The Automatic Electrical Devices Co., Cincinnati	18.50
Weston Electrical Instrument Co., Newark, N. J.	18.00
Fansteel Products Co., Inc., North Chicago, Ill.	18.00
Valley Electric Co., St. Louis	18.00
Signal Electric Mfg. Co., Menominee, Wis.	16.50
Rauland Manufacturing Co., Chicago	16.50
The Sterling Mfg. Co., Cleveland	16.00
Westinghouse Union Battery Co., Swissvale, Pa.	15.50
Diamond State Fibre Co., Bridgeport, Pa.	15.00
American Transformer Co., Newark, N. J.	14.00
Roller-Smith Co., New York City	13.75
American Hard Rubber Co., New York City	13.85
The Riggs Mfg. Co., Urbana, Ohio	12.50
Post Electric Co., New York City	11.00
U. S. Tool Co., Newark, N. J.	4.75
The Hart & Hegeman Co., Hartford	1.70

#### GRAND PRIZE

Grebe 200-watt C.W., I.C.W., Phone Transmitter, Value \$1100.00.

#### GROUP A

First: Zenith 1R Receiver and 2M two-step amplifier; 1 Atlas Loud Speaker; 1 Homecharger; 1 pair Baldwin type C phones; \$8.00 selection from

Howard Radio Co.; 1 Eveready 2767 battery; 1 Chelsea A.F. transformer; 1 Chelsea variable condenser; \$5.00 cash from the Bakelite Corp.; 1 Premier Microstat; 1 Burgess 25155 battery; 1 Unity vernier rheostat; 1 601-T Dubilier condenser.

Second: 1 Crosley Model X receiver; 1 Radiocorp UP-1368 C.W. power transformer; 1 pair Baldwin type E phones; \$8.00 selection from Howard Radio Co.; 1 Metaletric soldering iron; 1 Burgess 22306 battery; \$5.00 cash from the Bakelite Corp.; 1 type 22-MG-2 B-battery; 1 Premier 23-plate condenser; 1 Eveready 2766 battery; 1 Chelsea A.F. transformer; 1 Burgess 25155 battery; 1 Bradleystat; 1 Unity cartridge rheostat; 1 Radion dial.

Third: 1 set Branstetter honeycomb D.L. coils; 1 Stromberg-Carlson 1-A loud speaker; \$8.00 selection from Howard Radio Co.; \$5.00 cash from the Bakelite Corp.; 1 Remler variometer; 1 C-301-A amplifier tube; 1 3/16 x 8 x 26 Radion panel; 1 Premier variocoupler; 1 Eveready 2766 battery; 1 Eveready 2764 battery; 1 Burgess 25155 battery; 1 pair Ambassador phones; 1 Bradleystat; 1 Unity vernier rheostat; 1 Chelsea rheostat; 1 Unity cartridge rheostat; 1 type 601-T Dubilier condenser; 1 Dubilier variadon.

Fourth: \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corporation; 1 Radiocorp UV-216 20-watt Kenetron; 1 Chelsea variocoupler; 1 Chelsea variometer; 1 Horne verni-tuner; 1 5-to-1 Hedgehog A.F. transformer; 1 Burgess 22156 battery; 1 Eveready 2766 battery; 1 pair Scientific phones; 1 Bradleystat; 2 Unity cartridge rheostats; 1 Eveready 27111 battery; 1 type 601-G Dubilier condenser; 1 type 601 Dubilier condenser.

Fifth: \$8.00 selection from Howard Radio Co.; 1 Hedgehog 5-to-1 A.F. transformer; 1 pair Red Head Model F phones; 1 Bradleystat; 1 Unity vernier rheostat.

#### GROUP B

First: 1 Zenith 3R receiver and three-step amplifier; 1 Atlas loud speaker; 1 Balkite battery charger; 1 pair Baldwin type G phones; \$8.00 selection from Howard Radio Co.; 1 General Radio 247W wavemeter and filter; \$5.00 cash from Bakelite Corporation; 1 Eveready 2767 battery; 1 Premier microstat; 1 Burgess 25155 battery; 1 Unity vernier rheostat.

Second: 1 Tuska type 225 receiver and two-step amplifier; 1 Western Electric 10-D loud speaker; 1 pair Baldwin type E phones; \$8.00 selection from Howard Radio Co.

Third: 1 set Coto-Coil (16) mounted coils; 1 Radiocorp UL-1008 oscillation transformer; 1 General Radio 300-D amplifying unit; \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corporation; 1 Remler variometer; 1 Premier variocoupler; 1 pair Stromberg-Carlson 2A phones; 1 General Radio 231A transformer; 1 Burgess 22306 battery; 1 General Radio 247H condenser; 1 pair Scientific phones; 2 Bradleystats; 1 Bradleystat; 1 Dubilier variadon; 1 Dubilier type 601 condenser; 1 Unity cartridge rheostat; 1 Eveready 2771 battery.

Fourth: \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corporation; 1 Horne verni-tuner; 1 Radiocorp UV-202 tube; 1 Chelsea variocoupler; 1 5-to-1 Hedgehog A.F. transformer; 1 Radio panel 3/16 x 7 x 21; 1 Burgess 22156 battery; 1 pair Scientific phones; 1 Bradleystat; 1 Eveready 2771 battery; 2 Unity cartridge rheostats; 1 R40 (Signal) crystal detector; 1 Hart & Hegeman rheostat; 1 Dubilier type 601 condenser.

Fifth: \$8.00 selection from Howard Radio Co.; 1 pair Red Head Model F phones; 1 5-to-1 Hedgehog transformer; 1 Unity vernier rheostat; 1 Bradleystat; 1 Dubilier type 601 condenser.

#### GROUP C

First: 1 Tuska Superdye receiver; 1 Atlas loud speaker; 1 Acme 200-watt power (C.W.) transformer; 1 Roller-Smith 0.5 amp. R.F. meter; 1 pair Baldwin type F phones; 1 Riggs battery charger; 1 Rauland push-pull amplifier; \$8.00 selection from Howard Radio Co.; 1 Burgess 22306 battery; \$5.00 cash from Bakelite Corp'n; 1 Premier 23 plate condenser; 1 Burgess 25155 battery; 1 Premier microstat; 1 Unity vernier rheostat; 2 Dubilier type 601 condensers.

Second: 1 type R2 Magnavox and 3-stage power amplifier; \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corp'n; 1 Bradleystat; 1

Bradley leak; 1 Eveready 27111 battery; 2 Dubilier type 601 condensers.

Third: 1 Tresco tuner and two-step amplifier; \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corp'n; 1 Radiocorp UV-202 tube; 1 Amertran A.F. transformer; 1 Remler variometer; 1 Premier variocoupler; 1 Rauland 3-to-1 A.F. transformer; 2 Bradleystats; 1 pair Ambassador phones; 1 Eveready 2771 battery; 1 Unity cartridge rheostat; 2 Dubilier type 601 condenser; 1 Ducon.

Fourth: \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corp'n; 1 Radiocorp UV-202 tube; 1 Premier variocoupler; 1 Horne verni-tuner; 1 Hedgehog 5-to-1 A.F. transformer; 1 Eveready 2766 battery; 1 Burgess 22156 battery; 1 pair Scientific phones; 1 Bradleystat; 1 Unity cartridge rheostat; 1 Chelsea socket; 1 Eveready 27111 battery; 1 Radion dial; 1 Hart & Hegeman rheostat; 1 Eveready 2771 battery; 1 Dubilier type 577 condenser.

Fifth: \$8.00 selection from Howard Radio Co.; 1 5-to-1 Hedgehog A.F. transformer; 1 C-301-A amplifier tube; 1 Chelsea socket; 1 General Radio type 156 socket; 1 Unity vernier rheostat.

#### GROUP D

First: 1 Colin B. Kennedy Model V complete receiver; 1 Esco battery charger; 1 Atlas loud speaker; 1 pair Baldwin type C phones; panel to order from Diamond State Fibre Co.; \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corp'n; 1 Chelsea variable condenser; 1 Premier microstat; 1 Burgess 22156 battery; 1 Unity vernier rheostat; 1 Dubilier Duratran.

Second: 1 Precision type 3B receiver; 1 Jewell wave meter; 1 Weston 0-10 Model 425 thermammeter; 1 Sterling 2900 battery charger; \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corp'n; 1 C-301-A amplifier tube; 1 Horne verni-tuner; 1 Premier 23-plate condenser; 1 Premier microstat; 1 pair Ambassador phones; 1 Bradleystat; 1 Radion dial; 1 Eveready 27111 battery; 1 Dubilier Duratran.

Third: 1 Remington .22 cal. rifle equipped with Maxim Silencer; \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corp'n; 1 Acme 30-henry choke; 1 Radiocorp UV-216 20-watt Kenetron; 1 Remler variometer; 1 Premier variocoupler; 1 Premier 23-plate condenser; 1 5-to-1 Hedgehog A.F. Transformer; 1 pair Ambassador phones; 1 Eveready 2764 battery; 1 Dubilier type 580 condenser.

Fourth: \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corp'n; 1 C-301-A amplifier tube; 1 Horne verni-tuner; 1 Hedgehog 5-to-1 A.F. transformer; 1 Radio corp UV-216 20-watt Kenetron; 1 U.S. Tool Co. condenser; 1 Burgess 22156 battery; 1 Eveready 2766 battery; 1 pair Scientific phones; 1 Unity cartridge rheostat; 1 Eveready 2771 battery.

Fifth: 1 C-301-A amplifier tube; \$8.00 selection from Howard Radio Co.; 1 5-to-1 Hedgehog A.F. transformer; 1 Unity vernier rheostat; 1 Radion dials; 1 Chelsea socket.

#### GROUP E

First: 1 Paragon complete receiver; 1 100-volt Kimley panel B battery; 1 Valley battery charger; 1 Atlas loud speaker; 1 pair Baldwin type F phones; \$10.00 cash from Bakelite Corp'n; \$8.00 selection from Howard Radio Co.; 1 Eveready 2767 battery; 1 Premier microstat; 1 Burgess 25155 battery; 1 Eveready 27111 battery; 1 Unity vernier rheostat.

Second: 1 A-2 (R. Mitchell) knock-down receiver; 1 Thordarson 900-watt plate transformer (mounted); 1 pair Baldwin type C phones; \$8.00 selection from Howard Radio Co.; 1 Kimley 22-MG-2 B-battery; 1 (Signal) type R21 Navy type receiving transformer; 1 Metaelectric soldering iron; 1 Premier 23-plate condenser; 1 pair Ambassador phones; 1 Burgess 25155 battery; 1 Bradleystat; 1 Unity vernier rheostat; 1 Unity cartridge rheostat; 1 Radion dial; 1 Dubilier type 580 condenser.

Third: 1 complete set of Curkoid coils with triple mounting; \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corp'n; 1 Amertran A.F. transformer; 1 Remler variometer; 1 Premier variocoupler; 1 Premier 23-plate condenser; 1 5-to-1 Hedgehog A.F. transformer; 1 Eveready 2766 battery; 1 Radion panel 3/16 x 7 x 18; 1 pair Ambassador phones; 1 Eveready 2771 battery; 1 Eveready 2764 battery; 1 Eveready 27111 battery; 1 Bradleystat; 1 Unity cartridge rheostat; 1 Chelsea rheostat.

Fourth: \$8.00 selection from Howard Radio Co.; \$5.00 cash from Bakelite Corp'n; 1 C-301-A amplifier tube; 1 Remler variometer; 1 Horne verni-tuner; 1 Hedgehog 5-to-1 A.F. transformer; 1 Burgess 22156 battery; 1 Signal 23-plate condenser; 1 pair Scientific phones; 1 Chelsea rheostat; 1 Dubilier type 580 condenser.

Fifth: \$8.00 selection from Howard Radio Co.; 1 Hedgehog 5-to-1 A.F. transformer; 1 pair Red Head Model F phones; 1 Bradley leak; 1 Unity vernier rheostat.

## Articles Welcome!

FOR the first time in many months we are able to dust off the old sign "Articles Welcome"—and hang it up for all to see. That's one of the things that the increased size of QST has done for us, and it's certainly great to know that we are once more able to print an article within a reasonable time after it arrives. Let the articles come!

Articles on the following subjects are scarce right now:

Synchronous Rectifiers that work and can be filtered.

Mercury Arc Rectifiers.

Building a really good station using one "5-watt" tube.

Counterpoises and experiments on them.

Short-wave work, either at 176 meters or else on the special waves.

Comparative results with good and poor apparatus in the same circuits.

Daylight transmission.

The Effect that the Aurora Boralis has on Radio.

An Amateur Tuner that does not send out a "Carrier."

How to Boost the League.

Making a Radio Club show enthusiasm.

Key-click-less Sending Sets.

How to Call and Send—in other words, how to become an operator.

Stories—good ones—are scarce, very scarce.

It always makes the editors feel much more kindly toward an article if it comes to the office in good condition, so we'll give everyone a fair chance by stating (once more) how we like to have articles look.

1—Make the text as complete as possible, omitting nothing at all; we'd a lot rather have to prune the number of words than to guess at some things that were left out. Just the same, "Write it short."

2—Use standard size typewriter paper if at all possible and in any case write with double spacing between lines. Use the typewriter if possible.

3—Illustrations should always be on separate sheets, not mixed in with the

written matter. Use large illustrations and plenty of them; again it is better for us to drop a few than to guess at those that were omitted. Diagrams may be in pencil but should have all necessary detail and be drawn with reasonable care.

4—Photographic illustrations *absolutely must* be good, to be useful in making a halftone for *QST*. The picture should measure at least  $3\frac{1}{4} \times 4\frac{1}{4}$ ", should be on glossy paper, and *must* be from a negative much better than those made by the ordin-

ary amateur. Have the picture made by someone that knows how to use an anastigmatic lens on apparatus. A portrait man is generally not as good as a commercial photographer.

5—Finally, *address the article correctly*. Many have been delayed or lost in the past because they were sent in the same envelope with a letter, or because they were not properly addressed. The correct address is "Editor, *QST*, 1045 Main Street, Hartford, Connecticut."

## Good Work of "Bustan" Continues

NO Government radio activities ever aroused such a chorus of approval as have the Bureau of Standards "Standard Frequency Transmissions" from station WWV at Washington, D.C. From every state east of the Rockies have come many letters commending this service that for the first time makes it possible for an amateur to know his wave length with precision, and at small cost. The demand for an extension of the service is very large.

The last previously announced schedule was printed in *QST* for November. The next schedules are given below; they can be heard and used at most points east of the Mississippi River and at many beyond.

The signals are of use in testing receiving sets, checking wave meters and adjusting transmitters. The accuracy is better than  $3/10$  of 1%. This is much better than the accuracy of any wave meter the average amateur will ever own.

Information on using the signals was given in the February 1923 issue of the

Radio Service Bulletin, also in the following places in *QST*—July, 1923,\* page 28, "U.S. Will Send Standard Waves for A.R. R.L.," May, 1923,\* page 47, "Laboratory Oscillators." More detailed information can be found in the Bureau of Standards Circular No. 92 which may be obtained on application from the Bureau of Standards, Washington, D. C.

All transmission is by "straight" unmodulated continuous-wave telegraphy. A complete frequency transmission consists of a general call (i.e., "QST de WWV"), a standard frequency dash, and announcements. The call continues for two minutes, including the statement of the *frequency*. (not wave length) being used. The standard-frequency dash is broken occasionally by the signature "WWV" and continues for about 4 minutes. The "announcement" is on the same wave length as the test that has just been sent and gives the *exact* frequency of the signal, measured while that signal was being sent. The next frequency is then announced and a 4 minute interval follows while adjustments are made.

The schedule is as follows:

Schedule of Frequencies in Kilocycles. (Approximate wave lengths in meters in parentheses)				
Eastern Std. Time	Jan. 7	Jan. 21	Feb. 5	Feb. 20
11:00 to 11:05 P.M.	150 (2000)	500 (600)	1300 (231)	150 (2000)
11:12 to 11:20 P.M.	205 (1463)	600 (500)	1400 (214)	205 (1463)
11:24 to 11:32 P.M.	260 (1153)	700 (428)	1500 (200)	260 (1153)
11:36 to 11:44 P.M.	315 (952)	833 (360)	1600 (187)	315 (952)
11:48 to 11:56 P.M.	370 (810)	900 (333)	1700 (176)	370 (810)
12:00 to 12:08 A.M.	435 (689)	1000 (300)	1800 (167)	435 (689)
12:12 to 12:20 A.M.	500 (600)	1200 (250)	1900 (158)	500 (600)
12:24 to 12:32 A.M.	570 (526)	1400 (214)	2000 (150)	570 (526)

\*Can be obtained from the *QST* Circulation Dept. at the regular price.

## 1XAM's Transmitter

By John L. Reinartz, 1QP-1XAM

This article describes an amateur sending set and antenna system that will work easily and efficiently anywhere in the amateur band of waves. Note Mr Reinartz's insistence upon two series condensers; this is strictly necessary with direct coupled sets using alternating plate supply. The three American stations that have worked French 8AB all reduced wave in this fashion. The special counterpoise is more a matter of convenience and of the three stations referred to one used the cage counterpoise, a second used a modified form of it and the third used a normal rectangular counterpoise.—Tech. Ed.

**A** GOOD amateur sending set should allow you to work your tubes at good efficiency and should allow prompt change of wave length over the amateur band, 150 to 220 meters.

At 1QP-1XAM there has been worked out experimentally a sending set and antenna system which do these things and also permit receiving on the same antenna system without a change-over (send-receive) switch.

In the Hartley circuit of Figure 1 adjust the grid and plate clips for best operation of the tube. We will find that it is now possible to change the setting of the

more nearly simulate the properties of an antenna and counterpoise such as we may connect to the helix when sending. First let us assume that the "dummy antenna" and the "dummy counterpoise" are exactly alike. Now if we set the antenna series condenser and the counterpoise series condenser at the same capacity we are sure that the current anti-node (and the voltage node) will be located at the filament clip. F. (See "The Nodal Point Explained" in September QST\* for reasons why this is important.) It is possible to change the variable condensers to any equal-capacity settings without moving the nodal point off the filament tap if the dummy antenna and the dummy counterpoise are exactly alike. To show the serious effect of moving the nodal point off the filament tap, try setting one condenser at 90 percent scale reading, the other at 10 percent scale reading, note the wave length, the plate input, and the current in the oscillating circuit. Now re-set the condensers so that the wave length is the same and the capacities of the condensers are the same. You will find that the two ammeters now read alike (and higher), also that the plate input has been reduced. All of this is to show why it would be nice to have a sending system with antenna and counterpoise series condensers that can be set at the same reading *without* having unpleasant things happen in the circuit.

Making an actual antenna system act in this same fashion is not quite so easy; in fact it cannot be done except with some error and over a limited range of wave lengths. However, the amateur band is

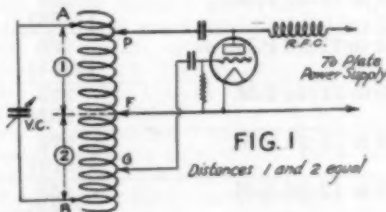


John L. Reinartz and The Set at 1QP-1XAM.

Reinartz needs no introduction; the set was one of the first two American stations to work a European amateur. This was not done once but repeatedly, and at last with but one tube in use. (Photo by Foto Topics, Inc.)

condenser V.C. over quite a range without any need to change either the plate or grid clips. Such flexibility applied to a sending set would be very useful.

If we replace the variable condenser by the equipment shown in Figure 2 we will



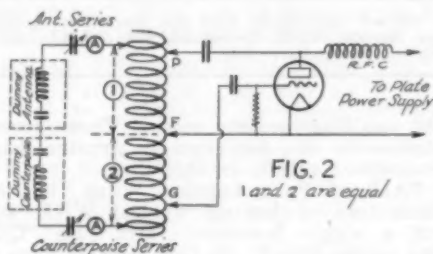
quite narrow and for amateur purposes the thing can be done. Evidently the antenna

\*Can be obtained from the QST Circulation Dept. at the regular price.



and the counterpoise should have the same fundamental wave length to earth, and also they should have the same inductance and capacity.

At 1XAM the antenna system has the proportions shown in Figure 3. The pur-



pose of the very narrow counterpoise and its high location is to reduce the capacity per foot to values not too much different from those of the antenna, so that the tuning effect of the two series condensers will be about the same. In fact at 1XAM the scheme operates perfectly between 125 and 180 meters. The error below 125 meters is small and no series condensers are used above 180 meters with this antenna. The method of adjusting the length of the counterpoise was as follows. The counterpoise and antenna clips were set the same number of turns from the filament clip, both series condensers set at half scale (same capacity), and the key pressed. See Fig. 4. Then the capacity of the counterpoise series condenser was slowly reduced and the plate input dropped, showing that the counterpoise cage was too long. This cage

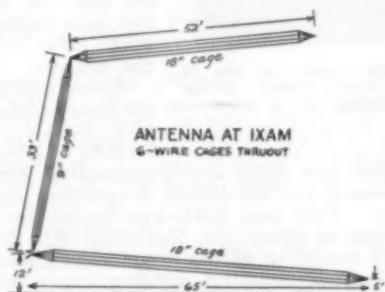


FIG. 3

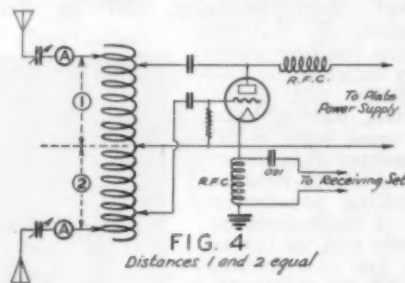
was shortened 6 inches at a time until any change from the equal setting for the two condensers caused the plate input to rise, indicating that the nodal point was then correctly located when the condensers were set alike. Of course this is strictly correct only in the center of the scale (where the adjustment was made) but, as was said above, the scheme works nicely over a 60-meter band at 1XAM.

Having made this adjustment, if one can

measure the fundamental of the antenna to earth and the counterpoise to earth, they will be found equal.

The input to the set can be changed instantly by moving the plate clip or changing the plate voltage, the wave length can be changed just as quickly by turning the two series condensers simultaneously (in fact they can be belted together as shown in the photo of 1MO, elsewhere in this issue). The two adjustments (power and wave length) are independent.

For the sake of safety against electrical shocks the filament clip should be grounded. If this is done directly a slight misadjustment of the nodal point will cause considerable currents to flow thru the ground connection which is not desirable. Therefore this ground connection is made thru a radio frequency choke (a single-layer coil will answer). See Figure 4. The receiving set may be connected in as shown and—unless the sending set is misadjusted—you can receive thru the transmitting circuit, doing



away with a change-over switch, always being able to hear the other station when the key is up.

Going a little farther, secure the use of a good wave meter, calibrate your two series antenna condensers so that you can instantly tell just what your sending wave is—and then calibrate the receiver too.

## NOTICE TO OUR NEWSSTAND READERS

As announced in our last issue, the Operating Department Report and the "Calls Heard" Department have been eliminated from the newsstand edition of QST because our non-member readers in general are not particularly interested in them. This results in a saving in expense which makes possible the publication of a larger and better QST.

These two departments are included in the edition supplied to members of the A.R.R.L. If you are interested in them, it is proof positive that you ought to be a member of the League. May we not direct you to the handy application blank appearing on page 88 of this issue?

## Splendid Contact With the "Bowdoin"

— WNP Helps To Make Some New Records Too —

Each month we are publishing an account of the contact maintained with the MacMillan Arctic Expedition Schooner "Bowdoin," WNP, now at Refuge Harbor, North Greenland, via A.R.R.L. stations. This is a report of operations in the month of November.—Ed.

**W**ITH the arrival of winter, contact with the "Bowdoin" became a much easier matter, with the result that in incomplete reports at hand we have definite record of twenty amateur stations working WNP during the month of November. Five of these were Canadians, five were 7's in our Northwestern Division, and five were 9's in the Dakota Division. This shows that the area of reliable communication is extending eastward. Good for the Dakota gang! Jack Barnsley, 9BP at Prince Rupert, B. C., remains the best gateway between the Expedition and civilization, having been in touch with WNP a matter of a dozen times in November, handling practically all of their message traffic and, as far as we are now aware, all of the press reports which have appeared in the daily papers.

All world's distance records for amateur two-way communication were smashed when Mix of WNP and Mr. R. Smith of 6CEU, Hilo, Hawaii, talked to each other for a quarter of an hour on the night of November 15th. The distance is about 4600 miles. Of course amateurs have been heard much farther, but this is the greatest DX worked. A remarkable point is that 6CEU used but three "5-watters" with 2.2 amperes in the antenna, chemically-rectified A.C. on the plates. Mix reports 6TQ of Honolulu, with the same power QSA also.

During the month WNP got in reliable contact with 6XAD-6ZW at Avalon, Calif., and much of his N.A.N.A. press was copied by Mott. 6ZW continues to pound in all along the east coast, and some very pretty relaying was done late in November when 1HX in Hartford passed numerous messages to WNP thru Mott's station and received the replies over the same route, a distance of over 6000 miles each way with

but one intermediate relay. These accomplishments are described in greater detail in another article in this issue.

7AIB of Port Angeles, Wash., has the distinction of having worked WNP with but a single 5-watter. Mix said "QRK like bricks here." In fact, Mix reports all the stations he works as very loud. WNP's signals are fairly good in most reports, except for very bad fading, complained of by almost everyone. Press dispatches report high winds around the expedition's location, and the antenna probably is being rocked

violently. Since freezing in Mix has erected a new radiating system, the aerial stretching forward from the ship's mast to some hills ahead, while a fan counterpoise of wires flat on the ice extends forward from the bow. He reports that he is still using the same tubes with which he set sail; no trouble has been experienced with 2000 volts on the plates.

Seven amateur stations picked by Mix (5ZAV, 7ABB, 6AWT, 6CGW, 6BZI, 9MC, and 8ZZ) are broadcasting American news to the MacMillan Expedition on schedule. POZ and GBL are copied for international news. On Nov. 26th Mix reported the reception of the broadcasting station at Glasgow, Scotland, sending music and calling America, signals loud. Traffic from the "Bowdoin" has been given preferred attention by the amateur stations thru which it passed, and in particular the Traffic Manager has laid out some "express routes" stretching across the country to 9BP by which it is expected traffic to and from WNP can be moved on schedule with the greatest speed.

Dispatches from MacMillan indicate that the radio installation on the "Bowdoin" is a great blessing. It has annihilated their isolation, it brings them entertainment and all the news of the world, and thru the



How the "Bowdoin," WNP, looks as she is frozen in the ice for the long Arctic winter. (From a photograph made by MacMillan on a previous expedition.)

amateur stations of the A.R.R.L. their business traffic and their news reports to the outside world are handled with all the speed and reliability of a wire-line connection.

The following summary lists all WNP reports received up to press-time. If you hear or work WNP, let us know so the report may be as complete as possible.

#### LOG OF A.R.R.L. STATIONS WITH "WNP"

**Night of Aug. 31—Sept. 1**  
Heard by 6CMM, San Francisco; incorrectly reported as 6CCM in our November issue.

**Oct. 15—16**

Worked by 7SC, Aberdeen, Wash.; 1 msg. sent.

**Oct. 24—25**

Heard by 1FD, Norwich, Conn.; QRZ QSS but whole msg. copied.

**Oct. 27—28**

Heard by E. J. Anderson, Chicago, QSA.

**Oct. 30—31**

Worked by Can. 9BP, Prince Rupert, B. C.; 1 msg. sent.

**Oct. 31—Nov. 1**

Worked by Can. 9BP, sent 2, received some calls heard. Heard by 9ACK, Jamestown, N. D.; 8CWK, Dayton, O.

**Nov. 2—3**

Worked by Can. 9BP, 5 msgs. sent. Heard by 9BSH, Cape Girardeau, Mo.; 7OY, Seattle.

**Nov. 3—4**

Worked by Can. 9BP, 8 msgs. rec'd including balance calls heard. Heard by 2BQC and 2CFB, Elizabeth, N. J.; 7FD, Seattle; 5CT, Duncan, B. C.

**Nov. 5—6**

Heard by 3GK, Toronto; 3NI, Ft. William, Ont.; 5ABT, Montgomery, Ala.

**Nov. 7—8**

Heard by 3APV, Chevy Chase, Md.; calling 9MC QSA.

**Nov. 8—9**

Worked by Can. 9BP, 5 msgs. rec'd including complete N.A.N.A. press; sent 7 and news. Heard by 5GO, Vancouver, B. C.; 5CT, Duncan, B. C.; 7ABB, Everett, Wash.; 7AIB, Pt. Angeles, Wash.

**Nov. 9—10**

Heard by 8CWK, Detroit.

**Nov. 10—11**

Reported by 8ARR, Detroit.

**Nov. 11—12**

Worked by 7AIB, Pt. Angeles, Wash., one 5-watter, took 1 msg. Exchanged calls with 2AGB, Summit, N. J. Worked by Can. 9BP, 5 msgs. sent, 3 rec'd. Heard by 8IN, Bellevue, Pa.; 6AHS, San Diego; 7AIY, Wenatchee, Wash.; Can. 5CT, Can. 5GO.

**Nov. 14—15**

Worked by Can. 9BP, 7 msgs. sent, 8 rec'd; 7ABB, Everett, Wash., QRK QRU; 7AIY, Wenatchee, Wash. Heard by Can. 5CT.

**Nov. 15—16**

Worked 15 mins. by 6CEU, Hilo, Hawaii, longest 2-way amateur DX ever recorded, 1 msg. rec'd; worked by Can. 9BP, 2 msgs. sent, 8 rec'd. Heard by 6AOL, Riverbank, Cal.; Can. 5GO.

**Nov. 16—17**

Heard by H. C. Barney, Providence, R. I.; 9DKB, Minot, N. D.

**Nov. 17—18**

Worked by 4CL, Edmonton, Alta., QSA QRM. Heard by 7AIY; 8CYT, Akron; 5BE, Ft. Worth, Tex.

**Nov. 18—19**

Worked by Can. 4CL again; took half his press msg. OK, QSA QRM. About this date WNP was worked by 7AIB in Alaska. Worked by Can. 9BP, 5 msgs. sent, 2 rec'd including 455 wds. N.A.N.A. press. Heard by 9DLF, Aneta, N. D.;

L. Strobel, Akron, O.; 3BPM, Philadelphia; 6AWT, San Francisco; 7ZU, Polytechnic, Mont.; 4EA, Winnipeg.

**Nov. 19—20**

Worked by Can. 9BP, 4 msgs. rec'd including 1000 words N.A.N.A. press, sent 1 msg. About this date also worked by Can. 4DQ. Worked by 5CT, Duncan, B. C.; QSA QSS, 1 msg. rec'd. Worked by Can. 3NI at 6:30 A.M. for 15 mins. QSA QSS QRU. Most of N.A.N.A. press also copied by 6XAD, Avalon, Cal. Also heard by 7FD, Seattle, 6AWT; 7AIB; 5AAH while at Boulder, Colo; Can. 5GO.

**Nov. 20—21**

Worked by Can. 9BP, 1 msg. sent, 5 rec'd; and by 9DKB, Minot, N. D., QRU. Heard by 9BSH; Can. 5GO.

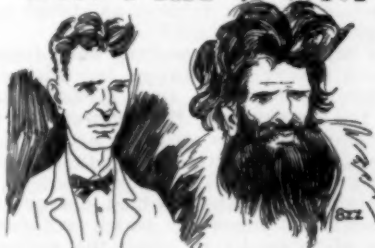
**Nov. 21—22**

Worked by Can. 9BP, 3 msgs. sent. Heard by 5ABH, New Orleans, and 9DBI, Chicago.

**Nov. 22—23**

Exchanged calls with 9DKB, Minot, N. D., lost in spark QRM. Worked by Can. 5GO, Vancouver, B.C., with two 5-watters; QSS out. Heard by 8BFH, Norwalk, O., calling 6XAD.

## DON MIX of WNP



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AS WNP

**Nov. 23—24**

Worked by Can. 9BP; 3 msgs. sent, one with ck 712; rec'd 5. Worked 20 mins. QSA by 9ACK, Jamestown, N. D.; 10 mins. by 9DKB; about this date apparently worked 7SF, Aberdeen, Wash.; worked 9BTT, Excelsior, Minn., 20 mins. QSA QSS QRU; about this date worked 9ZT, Minneapolis, and 9APF, Denver, no particulars. Heard by 9CVS, Forest Park, Ill.; 1AUG, Winsted, Conn.

**Nov. 24—25**

Worked half hour by 7ZU, Polytechnic, Mont., QRZ QSS QRU. Heard by 8BXX, Norwalk, O.; 9DLF, Aneta, N. D.; 7MT, Arlington, Wash.; 2BXW, Altamont, N. Y.; F. H. Canfield, Newark, N. J.; Can. 5GO.

**Nov. 25—26**

Worked by 6XAD who was QSO 1HX and handled message Hartford to WNP and return in 8 mins. 30 secs., new record; also message to Opr. Mix from his mother in 7½ mins. from his home. Worked by 9AVZ, Pierre, S. D., QRK QRU; 7ABB, Everett, Wash., 1 msg. sent. Heard by 7ABB; H. C. Barney, Providence, R. I.; 3CC, Abington, Pa.; 7MT, 2BXW.

**Nov. 26—27**

Worked by 6XAD who was QSO 1HX in Hartford; handled series of messages in fast time, establishing new records for speed and longest relays, 5 mins. 6 sec. round trip from 1HX. Worked by Can. 9BP; sent 2 msgs. Heard by 7ABB and 7KS.

**Nov. 27—28**

Heard by 8CYT, Akron.

**Nov. 28—29**

Heard by 1AUG, Winsted, Conn., QRZ QSS.

**Nov. 29—30**

Worked by Can. 9BP; 5 msgs. sent, 2 rec'd.

**Nov. 30—Dec. 1.**

Heard by P. H. Prouse, Jericho Springs, Mo.

## Information on Receiving Tubes for A.R.R.L. Questioners

By J. C. Warner\*

In Two Parts: Part I

It is a privilege to count amongst A.R.R.L.'s friends the Research Laboratory of the General Electric Co. This is the organization which is constantly developing the "G.E." line of vacuum tubes, its latest contribution being the excellent new tubes with "XL" filaments.

This article, by a member of the Research Laboratory, answers the questions submitted by our members in accordance with the special arrangement announced on page 17 of the August issue. The questions were so numerous and varied that this paper, originally intended for the December number, was carried over to this month.—Tech. Ed.

THE material contained in this discussion of receiving tubes, their characteristics and use, is based on a number of questions which were sent to the Technical Editor of QST in response to his request as stated in the August number of QST.

As was to be expected, the questions covered a very wide range, but with a few exceptions they fall into distinct classes and for convenience the answers to these questions have been grouped accordingly.

The writer is attempting to answer as fully as possible all questions sent in, only omitting two or three which did not refer to receiving tubes or which referred to types of tubes about which the writer has no information.

There seems to be much interest in the relative merits and characteristics of the three filament materials now in common use—pure tungsten, thoriated tungsten (XL), and oxide coated platinum.

### Tungsten

The material used in the pure tungsten filament is practically the same as is employed in the ordinary incandescent lamp. It is capable of withstanding very high temperatures and in a vacuum tube burns at a white heat (about 2150°C. or more). Pure tungsten filaments can be made very uniform both as to voltage and current as well as electron emission. However, the electron emission efficiency, that is, the electron emission per watt of filament power, is low compared with that given by the XL and oxide coated types.

### "XL"

The XL or thoriated filament differs from the pure tungsten filament in that a small amount of a thorium compound is mixed with the tungsten before the wire is drawn. Thorium has the property of giving off electrons at a much lower temperature than tungsten (about 1700°C.) so that this filament not only has a longer life, but at the normal operating temperature gives a much higher emission efficiency.

The burnout temperature of the XL

tungsten is approximately the same as for ordinary tungsten, but the XL filament must be operated at a lower temperature than tungsten, otherwise the thorium would be evaporated from the surface of the filament so rapidly that the supply would soon be exhausted. Thus the life of an XL filament is *almost never ended by actual burn-out* unless excessive voltage is applied.

The electron emission of the XL filament is given by a layer of thorium which is only one molecule deep on the surface of the wire, and the operating temperature is so chosen that there is a slow diffusion of thorium from inside the wire to the surface which supplies any losses of thorium molecules caused by evaporation or positive ion bombardment. As long as the supply of thorium is sufficient to maintain this surface layer the emission remains practically unchanged and, instead of gradually decreasing during the life of the tube, the emission is constant until shortly before the end of life when it falls off rapidly. If too high filament voltage is used the rate of evaporation of thorium from the surface is increased more rapidly than the rate of diffusion of thorium to the surface and the emission will fall. If the high voltage is not applied for too long a time the original emission may be restored by operating at normal filament voltage without plate voltage for ten minutes or more, the time required for activation depending upon the duration of the over-voltage period. Too long application of excess voltage, of course, will completely exhaust the thorium supply and render the tube useless.

The high emission efficiency of the XL filament, as compared with that of pure tungsten, is clearly illustrated in Figure 1, which gives the total emission and emission-efficiency for two typical filaments. Under normal operating conditions the UV-201 filament requires 5 watts to give a total emission of 8 milliamperes or 1.6 milliamperes per watt. The UV-201-A requires only 1.25 watts and gives 45 milliamperes emission making an efficiency of 36 milliamperes per watt.

In comparing the emission efficiencies of

\*Research Laboratory, General Electric Co.



two filaments the life of the two should also be considered since large filaments can often be operated at higher temperatures than small filaments, assuming the same life. For this reason, any comparison should be made between tubes designed for the same sort of service as is the case with the UV-201 and UV-201-A, although the UV-201-A has a considerably longer life than the UV-201.

#### Coated Filaments

The coated filament differs materially from the tungsten filaments in that it consists of a metallic base, usually platinum, on which is placed a coating of oxides which gives high electron activity. Its operating temperature (about  $1000^{\circ}\text{C}$ ) is even lower than that of the XL filament and it should never be burned above a dull red heat.

Coated filaments give very high electron emission initially and the initial emission efficiency is often higher than that of the XL filament. However, there is considerable variation in different tubes of the same type and there is a tendency for the emission to decrease as the tube is used so that for present day tubes the average figures for this quantity are about the same as with the XL filament when the whole life of the filament is considered.

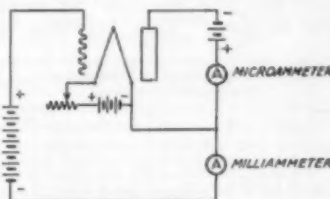
The end of life of the coated filament is usually caused either by loss of emission or by the formation of a hot spot and subsequent burnout at some point where the coating has been evaporated from the metal.

Excessive filament voltage affects the

emission of the pure tungsten filament, but it also increases the rate of evaporation of the tungsten and so shortens the life.

In the case of the XL filament the emission is increased temporarily, but as has already been explained, the increase in the rate of evaporation of the thorium causes a deficiency in the surface layer which soon reduces the emission and if the excessive temperature is continued the life is greatly shortened.

The coated filament also shows an increase in emission when the temperature is increased above normal, but at the same



CIRCUIT FOR MEASURING GAS PRESSURE  
IN RECEIVING TUBES

FIG. 2

time the coating evaporates at a high rate which, of course, decreases the life. However, after a period of overload the emission at normal temperature may show a temporary increase over its original value.

The choice as to whether the XL or coated filament is to be used in a tube depends principally on the service for which the tube is intended. The coated filament is better suited to use in tubes designed for very low filament voltage because for a given voltage and current it has a greater length. On the other hand, the XL filament can be made in smaller sizes and is more suitable for a low current tube. The XL filament is well able to withstand high voltage bombardment and is therefore easily adapted to use in power tubes, also the coated filament has been used successfully in such tubes.

The life of a vacuum tube depends on so many different factors that it is very difficult to give a definite figure which has any useful meaning. In fact, the case is somewhat similar to the life of an automobile—it all depends on how it is used. Under certain standardized conditions, such as are recommended in the instruction sheets which accompany most tubes, the life can be predicted with fair accuracy; but since tubes are used under widely different conditions, often with no attention paid to the recommended voltages, the life may be either greater or less than the predicted life expectation.

With regard to plate overload it should be remembered that a reasonable plate voltage without grid bias may do as much

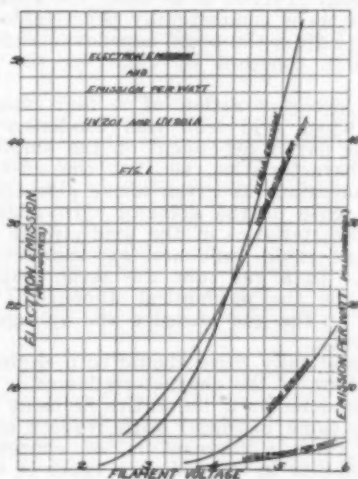


Fig. 1

three materials similarly to the extent that the life of the filament is shortened, but for a different reason in each case. The higher temperature increases the electron

harm as excessive plate voltage itself. The life of a tube such as the UV-199 and UV-201-A is approximately the same at 100 volts plate as to 40 volts, but only if proper grid bias is employed. Also the life of different tubes of the same type is fairly uniform if instructions are followed; but under abnormal conditions some tubes may last their usual life expectation while others may show a much earlier failure. In other words, departure from safe operating conditions tends to cause non-uniform as well as shorter life.

On account of the exhaust method in making XL filament tubes there is a marked tendency for the vacuum to improve as the tube is used. This, together with the

pheric pressure is approximately 760 mm. the maximum in an XL tube is less than one half of a millionth of atmospheric pressure. A majority of tubes do not even approach this limit during the factory test and after a short period of use many tubes "clean up" until in the test circuit there is no readable deflection of the micro-ammeter, showing that the pressure has decreased to or perhaps .001 micron or less.

#### Grid and Plate Design

One question was asked as to the influence of the mechanical dimensions and spacings on the characteristics of a tube. The exact relation between the tube constants and the mechanical dimensions can only be expressed by a somewhat complicated mathematical formula, but speaking in approximate terms the effectiveness of a high vacuum tube as an amplifier is increased as the length of the filament and the effective area of the other elements are increased. It is also increased as the spacings between are decreased. This, of course, assumes that sufficient electron emission is available and that suitable grid and plate voltages are employed. The amplification constant is easily varied through almost any range by changing the number of turns per inch of the grid winding. Changing the amplification constant by varying the grid turns also changes the plate impedance in the same direction, although not always to the same extent. The larger the size of grid wire and, within certain limits, the greater the distance between grid and plate, the higher will be the amplification constant. The usual practice is to make the spacings as close as is commercially practicable and then to adjust the plate impedance and amplification constant by changing the grid turns.

The detector action of a high vacuum tube, when grid leak and condenser are used, is partly dependent on the amplification characteristics, so that the effect of the dimensions as given above also applies to the case of the detector. In addition, the characteristics of the grid circuit have a considerable influence on the detector action. In a gas tube the action depends partly on the mechanical dimensions and partly on the gas pressure and voltage adjustments.

Theoretically there should be a slight improvement in the characteristics of a high vacuum detector if the entire filament were on the same potential with respect to the grid. Such a filament is, of course, an impossibility in the ordinary types of tubes and it is doubtful if the improvement would be enough to be noticeable.

#### Distortion

The question was asked as to the cause of distortion in radio circuits and why a crystal appears to give less distortion than

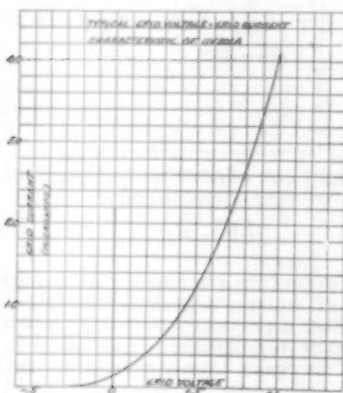


Fig. 3

uniform emission, prevents any noticeable change in the constants of the tube until the end of life and the voltages required do not change during the life of the tube. The silvery or colored coating on the bulb appears during the exhaust process and is caused by the deposit of substances in the clean-up of the gas.

In the oxide coated filament type, also, there is a clean-up agent which helps in producing and maintaining a good vacuum during the life of the tube. This chemical agent does not appear on the bulb, however, but remains on the glass stem.

Each tube, whether XL or coated filament type, is required to pass a gas test before leaving the factory, the test being made in a circuit similar to that shown in Figure 2. Here the grid is made the anode and the plate is made slightly negative in order to attract any positive ions formed in the region between grid and plate. The positive ion current passing through a sensitive microammeter gives a reading which is an indication of the gas pressure in the tube. The limits are set so that all tubes which leave the factory must have less than about .2 micron pressure. A micron is equal to 1/1000 of a millimeter and since atmos-

a tube detector. Distortion may be caused by any or all of a number of different things, so that it is often difficult to isolate the exact causes in any given case. It is commonly supposed that a crystal detector gives better reproduction of speech and music than does a tube detector, because a tube does not have a linear relation between input radio frequency voltage and output audio frequency current. That is, for moderate signal voltages the output current or voltage is roughly proportional

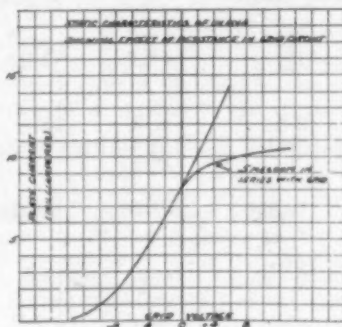


Fig. 4

to the square of the input voltage. However, almost all crystals, although giving less response, have much the same shaped characteristics so that there is little to the claim that the tube, unless regenerating, causes more distortion in this way. The true explanation is probably that the tube is more often associated with audio frequency amplifiers which directly or indirectly cause distortion. Also the greater sensitivity of the tube detector may cause the phones to be forced to the point where bad distortion occurs in the phones themselves, while if the crystal were used, the weaker response would appear undistorted. The sort of distortion which is caused by the curvature of the characteristics, either of the crystal or tube, is such that it can hardly be noticed unless the listener is thoroughly familiar with the voice or instrument to which he is listening. That is, the curvature introduces second and higher harmonics in the output, but equally so for all frequencies, so that the result is a slight change in the apparent pitch and tonal quality which, however, does little to make the reproduction any less pleasing than the original.

A regenerative detector may cause very bad distortion, but for a different reason. A modulated wave is a combination of the carrier wave and a number of higher and lower frequencies comprising the "side-band." For perfect reproduction these side frequencies must all be amplified and rectified equally. If the regeneration in the detector circuit is increased until the

tube is on the verge of oscillation the grid circuit actually becomes so sharply tuned that the side-bands are partly cut off, causing very objectionable distortion.

Another more infrequent cause of distortion is the use of incorrect values of grid leak and condenser. That is, if too high resistance or too large capacity is used, the condenser may not be able to discharge quickly enough to maintain the form of the original voltage wave. The proper choice of these values will be considered more in detail in a later paragraph.

Distortion in the audio frequency circuits may be due to the characteristics of the interstage coupling or to the tubes themselves, if they are used incorrectly or forced beyond reasonable limits. The impedance and step-up ratio of all transformers varies more or less for different frequencies, hence the amplification is greater for some frequencies than for others.

Under incorrect conditions the tubes may cause distortion in two ways. If the input voltage is made too high for the tube, the relation between output and input is no longer linear and distortion occurs. In general, the higher the plate voltage (assuming correct grid bias) the greater can the input voltage be without causing distortion. This, in fact, is the primary reason for using high plate voltages on amplifier tubes which are used to operate large loud speakers. If no grid bias is used, the grid of the tube becomes positive during part of the cycle and draws current. This current must pass through the secondary of the coupling transformer which has a very high impedance, in some cases as high

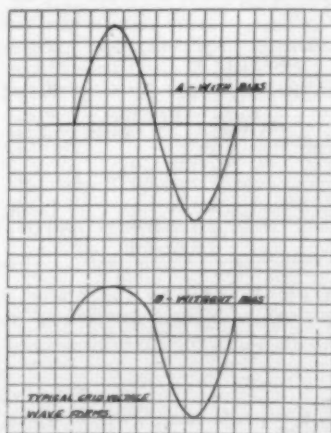


Fig. 5

as  $\frac{1}{2}$  megohm or more, and the voltage drop in this winding is, of course, lost to the grid of the tube. Since this occurs on only one-half of the cycle, the resulting grid voltage wave is lop-sided and cannot

	WD-11 C-11	WD-12 C-12	UV-199 C-299	UV-200 C-300	UV-201-A C-301-A
<b>Filament Circuit Data</b>					
Battery Source Voltage	1.5	1.5	4.5	6.0	6.0
Fil. Terminal Voltage	1.1	1.1	3.0	5.0	5.0
Filament Current	0.25	0.25	0.06	1.0	0.25
<b>Plate Voltage</b>					
Detector	20-45	20-45	20-45	15-23.3	20-45
Amplifier	40-100 (Note 2)	40-100 (Note 2)	40-100 (Note 3)	....	40-100 (Note 1)
<b>Dimensions Overall</b>					
Height Maximum	4 $\frac{3}{8}$ "	3 $\frac{1}{8}$ "	3 $\frac{1}{2}$ "	4 $\frac{5}{8}$ "	4 $\frac{5}{8}$ "
Diameter Maximum	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1"	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "
<b>For Detection</b>					
Grid Leak Megohms	2-3	2-3	2-5	$\frac{1}{2}$ -2	2-5
Grid Condenser $\mu$ fd.	.00025	.00025	.00025	.00025 to .0005	.00025
<b>Plate Impedance (Approx.) in Ohms</b>					
	19,000	19,000	18,500	9,000	16,500
<b>Amplification Constant (Approx.)</b>					
	6.5	6.5	6.25	....	8.0
<b>Mutual Conductance in Micromhos</b>					
	340*	340*	340*	....	485*
<b>Plate Current in Milli-amperes (With Zero Grid)</b>					
Plate Voltages				Detector:	
20	0.3	0.3	0.25	0.25 to 1.0	1.0
40	1.2	1.2	1.1		2.6
60			2.4		4.8
80	3.9	3.9	3.9		6.0
90					7.5
100					6-7.5
<b>Internal Capacities (<math>\mu</math>fd)</b>					
	4.5-6.0	4.0-5.5	3.5-4		

NOTE 1 UV-201-A, C-301-A		NOTE 2 WD-11, WD-12, C-11, C-12		NOTE 3 UV-199, C-299	
Plate Voltage	Negative Grid Bias Voltage or "C" Battery	Plate Voltage	Negative Grid Bias Voltage or "C" Battery	Plate Voltage	Negative Grid Bias Voltage or "C" Battery
40	0.5 to 1.0			40	0.5 to 1.0
60	1.0 to 3.0	45	0	60	1.0 to 3.0
80	3.0 to 4.5	60	1.5	80	3.0 to 4.5
100	4.5 to 6.0	80 to 100	3.0	100	4.5 to 6.0
120	6.0 to 9.0				

NOTE 4: All of the above values are based on approximate averages taken over long periods of time. Individual tubes may vary somewhat from figures shown.

\*At 40 Volts on Plate and Zero Grid.

Fig. 6

give true reproduction in the output of the tube.

#### How to Use the Grid Bias

Figures 3, 4, and 5 illustrate the above action. Figure 3 gives a typical grid-voltage-grid-current curve for a high vacuum tube and it will be noticed that the grid current starts at a small negative value then rises slowly until positive volt-

ages are reached, after which it rises more sharply. Figure 4 shows the effect on the static grid-voltage-plate-current characteristic of placing a high resistance in series with the grid. The plate current instead of rising rapidly as the grid voltage becomes positive, flattens out and shows very little increase. This is because most of the applied voltage is lost in the high resistance



and so is not effective in increasing the plate current. In a qualitative sort of way, this illustrates what happens in an amplifying transformer when the grid voltage is allowed to swing positive. Figure 5 shows what may happen to the wave form in a typical case. The true sine wave, Curve A, represents the voltage induced in the secondary of the transformer, which is approximately the same as the terminal grid voltage when bias is used. Curve B shows the distorted wave which results from use of no bias. If correct grid bias is used the grid does not become positive at any time and the voltage drop in the transformer is negligible, so that practically the entire voltage induced in the secondary windings is applied to the terminals of the tube.

There are other reasons for using grid bias on amplifier tubes besides the very important one given above, which dealt only with comparatively strong signals. Reference again to Figure 3 shows that the grid current is not zero even when the grid voltage is zero; that is, when it is connected to the negative end of the filament. From this it follows that even on the weakest signals there is a small grid current if the grid return is connected directly to the negative filament terminal. It is

assumed that in this case the plate voltage is not over 40 and that head telephones are being used. Since over a small region the curvature of the grid characteristic is not very great, this is not a serious cause of distortion, but the current flowing through the transformer does cause a voltage drop which weakens the signal somewhat. The amount of grid current at zero grid voltage varies considerably in different tubes and it sometimes is so small as to be negligible, but in general a grid bias of .25 to 1.0 volt gives better and more uniform amplification. This is easily provided by placing the filament rheostat in the negative filament lead and connecting the grid return not to the negative side of the filament, but to the negative side of the filament battery. In this way the voltage drop across the rheostat serves as grid bias.

A third reason for using grid bias at the higher plate voltages is to reduce the plate current and so lessen the chance of over-loading the tube. In this way the life of the plate battery is lengthened also.

The various questions as to tube constants and the proper voltages to be used are best answered by reference to the table which is given in Figure 6.

*(To be concluded in the February issue.)*

## The Growth of the Experimenters' Section

By S. Kruse, Technical Editor

AT the beginning we were sure that the radio experimenters in A.R.R.L. wanted some way of exchanging ideas, just as the brass-pounding traffic handlers of the Operating Department do. But we did not realize how many of the experimenters there were—we thought they were in the minority, possibly only a very few altogether. The famous full-page questionnaire of the July issue of *QST* showed a surprising interest in the experimental side of radio—the laboratory portion of amateurizing—and we began to suspect that the interest might be large.

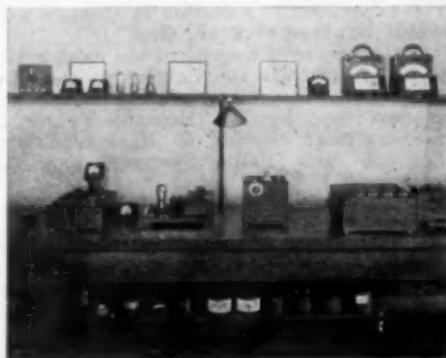
So we printed in a recent issue a modest little note to the effect that we would like to hear from experimenters who were willing to tackle some of the jobs that confront the amateur. We expected replies—we expected quite a number of replies—but we never expected to be hopelessly snowed under by hundreds of letters.

That is exactly what happened; we have not yet got thoroly on our feet again and at the present time the experimenters' correspondence is badly in arrears but is being caught up.

### What Has Happened

The names of the men who wrote in have

been filed and each of them sent two mimeographed lists of the branches of work that can be undertaken for the amateur. The experimenter keeps one of these lists, marks his class of work on the other and returns



The Laboratory of W. W. Harper at Ottumwa, Iowa.

it to this department. Knowing what men are available, knowing something of their apparatus, it is now possible to write for

them outlines along which they may work. That is the stage of the work at the present time—some jobs are already well under way while others have not yet been outlined. The other outlines are now in preparation and will be in the mail before this magazine.

#### What Is Still to Happen

With several hundred men working on our problems we found out some things worth knowing about amateur radio. But it has been uphill work because the experimenter often did not know of the "brass pounder's" problem and the key man did not know where to turn for his help. At the same time also a number of experimenters have often worked on the same task—none of them knowing of the work done by the others.

This is the sort of thing that the "Experimenter's Section" can help in: to provide contact between the men and the job and to provide contact between the men who are working the same job.

All this sounds a good bit like an advertisement for an employment agency, but it is different because we know the co-operative spirit of amateur radio and are sure that it will work out here as well as it has in the field of message traffic.

It will not be necessary or desirable to build such an elaborate organization as that of our Operating Department, but it will certainly be necessary to appoint district representatives—call them District Experiment Chiefs—and provide them with the facilities to exchange information between the men in the division, much as the Division Traffic Managers handle matters. Some of these men are in sight—others are still to be found.

#### Where We Are Today

We are far from having arrived at a smoothly-running machine, but we can say, "The experimenter's section is at work with several hundred men enrolled."

At the present time one of the most active pieces of work is the development of the short-wave transmitter described in our October issue by Mr. Howard Tytzer of the American Radio & Research Corp. (See "A New Radio System," page 15, October QST.)\*

Mr. Tytzer has taken charge of this work and at present has quite a large number of men at work—over 70 letters having been received from men who wish to participate. A letter has been prepared in which are given the results of some tests and this letter has gone to all those that are working on the problem and is also available to others who will write Mr. Tytzer in care of Amrad at Medford Hillside, Mass. However, please be reasonable and do not

ask for the report unless you wish to aid in the tests and development.

The list of the men working with Mr. Tytzer is unfortunately too long to be reproduced here, but they are in many cases equipped to do excellent work as is shown by the illustration of the laboratory of one of these men.

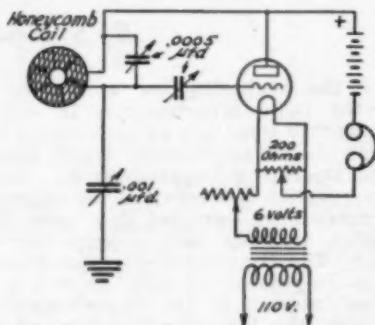
## The Power Lines In A Double Role

By Six Zee Jay

I HAVE a little stunt for eliminating both the "A" battery and the antenna of a portable set. This has given such good results that I am passing it on to the gang.

From the figure it will be noted that a small step-down transformer is used to light the filament of the VT. Usually the hum of the electric light lines is quite bothersome but if a potentiometer is shunted across the 6-volt supply this hum can be practically eliminated by finding the "balance point." The circuit is the standard DeForest Ultra-Audio, used by most of us at one time or another. This circuit will oscillate continuously if some means isn't used to control it. To do this is very simple—use a 23-plate variable grid condenser—.0005 microfarads.

Believing that this circuit was super-



sensitive I tried it with a 6-volt storage battery to light the filament. But there was ND, Nil. Then it was shifted back to the circuit given and—presto!! there they were!! The power line acts as the filament supply and the antenna.

Not very much 200-meter DX work has been done with this circuit. However, 600 meter sparks are very consistent and I can see no reason why just as good can't be done on the broadcast and amateur waves. (That is a good guess; we tried the stunt at 10A and amateur C.W. simply rolled in. Not much luck with amateur sparks as the 60-cycle hum is much worse

(Concluded on page 62)

\*Can be obtained from the QST Circulation Dept. at the regular price.

## Help Wanted

The Advertising Department Solicits Your Cooperation

By Edwin C. Adams, QST Advertising Manager

THE A.R.R.L. and QST, its magazine, are co-operative institutions. Neither can live without the hearty participation of our members and readers. Many of you fellows are active in the Operating Department, others of you are helping "Jake" Bolles blazon the achievements of amateur radio all over the front page, and still more of you help make QST the valuable magazine it is by your articles and communications.

Now that's very FB for the League and QST, and also for the departments of Messrs. Bolles, Kruse, Schnell, and Mason. How about giving the advertising manager a boost too, for the betterment of QST?

As you've so often been told, QST's primary and principal source of revenue is from its advertising. This not only has to make QST self-supporting, but must pay almost the entire League expenses. The more advertising we can get, the more money will be available for League activities, and—get this—the larger can we make QST, which means more reading pages.

If QST were a strictly commercial magazine, with no other financial obligations, it could afford to go out and hire advertising representatives in the big centers, and spend a lot of money in intensive advertising solicitation. But inasmuch as it can't,

what other means can we use to increase our advertising, and thus expand all that is dependent on it? We can use YOUR co-operation, as a loyal league member, as an enthusiastic reader of QST. Here's how.

First, an advertiser must be sold on QST as an advertising medium, and, second, he

must secure enough tangible results to justify him in continuing to spend his money for space in our columns.

Take a look at the letter reproduced here. That's one way to help the advertising department to sell QST. If you see or learn of any apparatus that you yourself are interested in and which your fellow amateurs would like to know about—write us about it, and drop a line to the manufacturer. Tell him that only through QST can he tell his story to the real radio men, the

backbone of the game, the men who not only represent a very large purchasing power in themselves but who also wield a tremendous influence on the purchase of apparatus by others.

We're not mind-readers, and in the ever changing game of amateur radio it's often hard to know just what the majority of our readers would like to see advertised in QST. If you'll only tell us, and give us a lift by boosting QST to the man who makes or handles the apparatus in question, we'll have more advertising of the kind that's



wanted, and we'll be able to give you a bigger QST into the bargain.

The job's only half done, however, when the ad appears in QST. Our readers have got to buy the goods, or recommend them to others, and let the advertiser know that QST is responsible for the sale, for only in this way can he judge whether he can afford to use our magazine.

How many of you fellows act on the request at the bottom of every advertising page and "always mention QST when writing to advertisers"? If you'll do that EVERY TIME, the advertiser can't help but know definitely just how much interest this advertising is causing. Let QST be your buying guide. With your co-operation in securing for our columns the ads of apparatus that the fellows want, you should be able to fill every want from QST. When possible, order direct from the ad, and tell

'em that QST gets the credit. If you have to buy QST-advertised apparatus from a dealer, tell him what started you, and "drop a card" to the advertiser telling him that through QST you have bought from such-and-such a dealer.

We print some 40,000 copies of QST every month, which are probably read by almost 100,000 people, of which YOU are one. There are surely half-a-dozen products advertised in this issue which you either need or are interested in. Write to the advertiser today, tell him you saw it in QST—and do it again next month and the time after that. Thus you can do your bit to help our A.R.R.L. and make QST bigger and better, and we'll be able to tell Warner, Schnell and Co. that they haven't anything on us. We've got our gang too, working for amateur radio.

## New Zealand Bedlam of Yankee Signals

*Hams Clash on 200 Meters During Transpacific Tests*

*By F. D. Bell, New Zealand's 4AA*

THE Trans-Pacific Tests are on and the American amateur signals are duly rocking in. Conditions for reception in New Zealand have been good so far except for two nights of very bad static. About 90 amateur calls have been logged at this station during the period of the test, although most of these were just handling ordinary traffic. Judging by reports received here by radio from

seems even louder at times than he was during the last ones. I think we all agree that his are certainly the loudest Yank signals ever received here, even including the redoubtable 6JD of glorious memory. We are all curious to learn his input and antenna current. Perhaps the next loudest is 6CGW, but his note is not a very good one for cutting thru the QRN, especially static of the continuous growly kind. Under such conditions we always search round until we get on to a chap with a good clear musical note like 6PL, even if he is not quite so loud. The I.C.W. chaps are all right under ideal conditions, but on a noisy night one is very apt to miss the dots altogether. Sometimes one gets properly bamboozled. For instance the other night (Tuesday Oct. 23rd N.Z.T.) I heard a station calling Australia which I logged as 6CMT. He sent the code phrase "Invoice is not made out." A few minutes later I heard 6CGA on the same wave length sending the code phrase "Wait for the weather to clear." I am still wondering if it was one and the same station both times—I rather think it was. The note was the same in both cases, being rather a harsh I.C.W. Then of course there are the sets which quack like an asthmatic duck every time the key is pressed—you all know them well. Unfortunately we don't understand their language out here so they usually quack in vain.

Looking thru my log I find the following



other experimenters throughout the Dominion, New Zealand should hand in a total of some hundreds by the end of the tests. The writer has also been QSO Melbourne (Australia) on several nights and they too reported excellent results. Apparently most, if not all, of 6KA's messages have been received there.

6KA is easily the star of these tests and



stations marked "very loud" in the period since my last list was sent in, namely Sept. 23rd to Oct. 27th:  
6KA, 6CGW, 6BVG, 6BVS, 6GX, 6CKP, 6AWT, 7HG, 7SF, 8VQ, 9BZI, 9APS, 9MC, 9CGU, 9ZV.

About 110 stations have been logged during this period and the list will appear in the "Calls Heard" section. I am sending a copy of my log to the Editor, so anyone who would like to check my reception of his signals can do so easily. The writer would appreciate cards from those amateurs who find the entries check OK. Some of you

hams should take a trip out here one of these days, if only to hear the din on 200 meters. You won't need to bring Mr. Godley's super with you, either.

There is no doubt in my mind that your transmitters are not only more numerous but far more efficient than they were a few months ago. I am in a fairly good position to judge since I have not altered a single thing on my receiver since hearing my first Yanks last February. Then it was quite a struggle to log half a dozen even on a

(Concluded on page 54)

## Low-Power Loop Transmission

By Oliver Wright, 6GD-6BKA

The amateur loop transmitter continues to make headway in low-power amateur transmission. The loop transmitter deserves much more attention than it has received, especially in crowded regions where interference is severe.—Editor.

**L**AST winter about this time I was fooling with a simple heterodyne using the Hartley circuit (Fig. 1) which I believe I got from QST. It consisted of a coil of about 20 turns, tapped in the middle, a .0005 variable condenser, an amplifying tube and the "A" and "B" supplies.

I found that I could take the heterodyne down cellar and hear its carrier wave practically as loud there as when it was about 8 feet from the set in the operating room on the second floor of the house.

That set me thinking and I constructed a small 5-turn flat spiral loop approximately 3 feet on a side and tapped in the middle and substituted it for the coil of Fig. 1 and found that this circuit still oscillated very nicely. You will notice that there is no grid condenser or grid leak. As long as the voltage is kept low they are not needed but as soon as the voltage is raised to over 150 volts it becomes necessary to add them for the proper and safe operation of the tubes.

With the set thus arranged, with 45 volts on the plate and drawing 2.5 mls, I was able to transmit about a mile but did not notice any great directional effects.

With 400 volts and drawing 20 mls we were able to work around Pasadena (where all these experiments were carried on) with great ease and worked stations in neighboring cities easily. At that power we were able to hold a wave meter near the loop and get the light to light at distances of up to 30 inches. The curves (see Fig. 2) represent the approximate extreme distances from the loop at which the wavemeter would light up. This indicated that the magnetic field was stronger about half

way from the center to the edge of the loop than at its center.

We soon found that the loop must be kept absolutely still during transmission, for if the wires vibrated the wave was changed enough to spoil reception. This

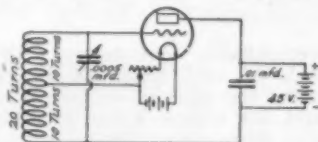


FIG. 1

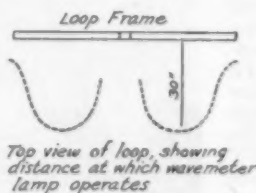


FIG. 2

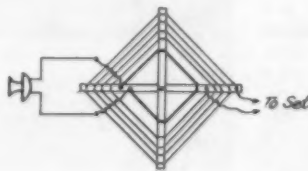


FIG. 3

difficulty was overcome by laying the wires along pieces of wood and fastening them

(Continued on page 43)



# Amateur Radio Stations



## 4FT, Wilmington, N. C.



The remarkable consistency with which the signals of 4FT reach to all parts of the country has caused many an amateur to rebuild his transmitting set, blow his money for more tubes, or put up a higher antenna in the hope that his results will be comparable. These amateurs would like to know what it is that has caused the signals of 4FT to out-distance all others time after time. We cannot say, except that we do not believe any one feature of the station is responsible. After reading the description perhaps you can draw your own conclusions.



The station is located on a level tract of ground ten miles from Wilmington, North Carolina. A special shack has been built to house the radio set, and all cur-

rent is supplied by a 32-volt farm lighting generator and a set of storage batteries.

The antenna and counterpoise attract considerable attention. There are two pipe masts, made of  $2\frac{1}{2}$ ", 2" and  $1\frac{1}{2}$ " pipe. The mast seen near the shack in the photo is 60 feet high while the other, located 80 feet to the rear, is 70 feet high. A tapering six-wire cage is suspended between the two with a tapering cage lead-in dropping straight down to the station building. Directly under the antenna is the 35-wire counterpoise, 14 feet high. Eight posts are set equidistant on the circumference of a circle 80 feet in diameter and a No. 10 bare copper wire is run between the tops of the posts, suitably insulated at each. The 35 counterpoise wires then lead from the top of the station building, which is at one side of the circle, to points along the No. 10 wire. A beautiful looking counterpoise is the result, though many will throw up their hands in horror at the idea of the counterpoise wires being of different lengths.

Entering the house, the transmitting and receiving apparatus is on a long table to the left of the room. The receiver is the familiar Paragon RA-10 with its companion two-stage amplifier. Above it is a Reinartz set and two-stage amplifier.

To the right of the receiver is the transmitting apparatus. Although there are sockets for four 50-watt tubes, plate power is not available to work this to capacity, hence but two tubes are generally used. Plate supply is obtained from a set of 32-volt batteries through an Esco motor-generator, a double-current machine giving 1000 volts for the plates and 12 volts for the filaments of the tubes. The reversed feedback circuit with series feed is used. Grid leak modulation is employed for phone. An antenna current of five amperes is obtained when working on C.W. and four amperes on phone.

There are very few stations in the country whose list of "DX" compares with that of 4FT. Amateurs in all states except Idaho and Utah have, at one time or another written Mr. Parsley, commenting on the fine signals from his station. Yet that is not all for 4FT's signals have also been heard by amateurs

in Canada, England, Holland, France, Porto Rico, New Zealand, Alaska, Hawaii, Japan, Straits of Gibralter, Mexico and Greenland and by ship operators at distances up to 9500 miles from Wilmington, N. C. The speech from 4FT has been heard by many stations within a radius of 2,500 miles. This station was about the first to communicate with Porto Rico and has handled a great deal of traffic for that place. The greatest accomplishment in two-way communication was made at the time of the last daylight transcontinental tests when, in lining up the route for the test just before daybreak, he worked 6AWT in San Francisco.

Donald McR. Parsley, the owner and operator of 4FT, would appreciate reports on his signals from amateurs in the two states mentioned above that have not yet been heard from. His address is Box 113, Wilmington, N. C.

## 7BJ, Vancouver, Washington

"The Old Man's" station itself has nothing on 7BJ. Vancouver, Washington, always did have a reputation for making lots of noise, ever since the days when

anted never to get hot. Various rectifiers have been used, a chemical one now being on the job. The jars are located just to the right of the transmitter but do



7ZJ's spark was heard as far as the Mississippi river; and George Sturley, ol'-time op and proprietor of 7BJ, is no slouch when it comes to upholding the reputation of his town.

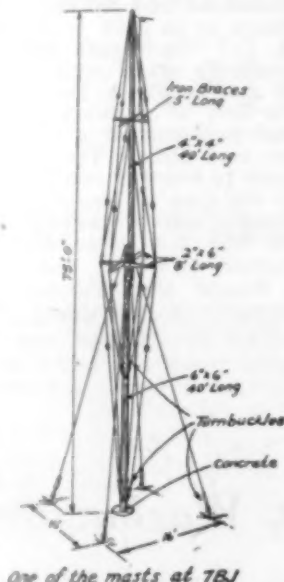
The transmitter at this station is a panel made for experimental work and uses either two 50-watt tubes or three 5-watt bottles. The plate supply is furnished with variations from 400 to 4000 volts by a plate transformer that is guar-

anteed never to get hot. The filter consists of a trap made of a 25-henry choke with a one-half microfarad condenser across it, connected in the positive plate lead. The coupled Hartley circuit, almost exactly like the one shown on page 53 of the November QST, is used. 7BJ says the small ax on the wall is a high power transmitter used for local work, while the brickyard two blocks down the street also comes in handy.

A single circuit receiver with three stages

of audio is seen to the left of the picture, one stage being used for DX; the rest for music. A home-made wavemeter beside the receiver is useful for checking the transmitted wave and also makes a wave trap that works wonderfully when the air is congested locally.

This station has been operated from an experimental point of view as well as for amateur traffic work. The usual monthly traffic is about 150 messages. The location of the station is not very favorable and includes among other things, a nice juicy power line which passes directly in front of the house. 7BJ has been heard in all states west of the Mississippi and has over a dozen reports on his signals from the extreme eastern states. The best DX record was made when 7BJ was heard in New Zealand in the first Transpacific Tests. Three 5-watt tubes were used at the time.



One of the masts at 7BJ

#### The Masts at 7BJ

For the average amateur who lives in

the city it is almost impossible to put up a real good transmitting antenna within the confines of a city lot. Geo. Sturley was confronted with this same difficulty, but overcame it in such a good way that the information is worth passing along.

He has two masts seventy-five feet high and the ground space required by each of them is only sixteen feet square. The details of construction can be observed from the accompanying sketch. Truss cables ( $\frac{1}{4}$  inch steel cable) run in two systems; one from the top of the mast over a set of five-foot iron truss-bars halfway up the topmast, over eight-foot 2x6-inch wooden truss-bars at the top of the mainmast, and then are made fast with turnbuckles midway up the mainmast. In addition, a second set of truss cables runs from midway up the topmast, over the large truss bars, and is made fast with turnbuckles to the base of the mast. The actual guying is done by four guy cables which run down from the top of the mainmast and are anchored securely to big, husky dead-men. These masts are very rigid and, being painted white, present a neat appearance. Two halyards are provided at the top of each, one for the antenna and the other for rigging up a bos'n's chair and tackle, enabling one to go aloft.

The antenna is of the inverted-L type. The flat-top section is only forty feet long, as the masts are rather close together, and consists of two six-wire cages each two feet in diameter swung at the ends of twelve-foot spreaders. The counterpoise is supported by long tapered spars fastened to the masts ten feet above the ground with lag screws.

Address all cards and letters to George Sturley, 206 E. 17th St., Vancouver, Washington.

## 2CEI, Bronx, New York

Here is one of the Second District stations which reaches out very consistently. Altho only one fifty-watt tube is used, 2CEI has been heard in 35 states, Panama and Canada. The antenna is only 45 feet high, so perhaps the well-filtered plate supply has a great deal to do with the way this station reaches out. The "DX Wallpaper" is good testimony that 2CEI "rattles the cans" over a good part of the United States. Much of the apparatus, including the receiver and the detector-amplifier units, is home-made. Stations in all districts are frequently copied. Robert Kraus, 2313 Fish



Avenue, Pelham Parkway, Bronx, N. Y., is the owner and chief operator.

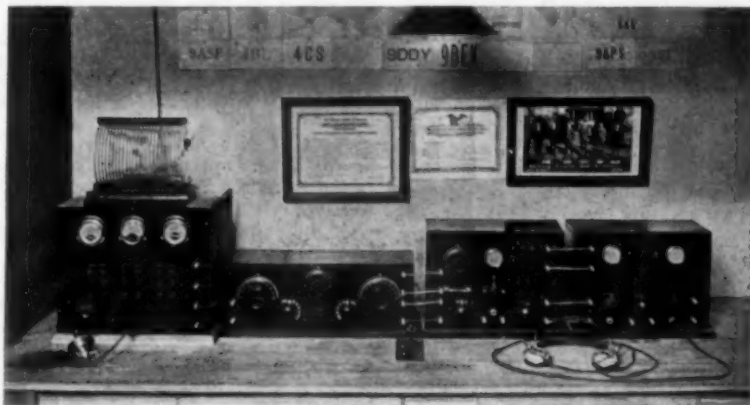


## 5GP, Anniston, Ala.

This station is an example in neatness of arrangement that many amateurs can well afford to profit by. The cabinet on the left encloses the transmitting apparatus which uses one fifty-watt tube in the reversed feedback circuit with series supply. Meters showing the plate current, antenna

1500 which is furnished through a home-made transformer.

To the right of the transmitter cabinet is a variometer-type receiver with the detector and amplifier cabinets to the right of the receiver. A four-wire tapering cage 65 feet long and 30 and 50 feet high at the two ends constitutes the antenna.



current and filament voltage are mounted on the front of the panel with switches to change from C.W. to phone just below them. The phone is used only for short-distance work and is modulated by a magnetic modulator. A chemical rectifier of 56 jars with a chemically pure borax solution rectifies the plate supply voltage of

The counterpoise is a five-wire fan, each wire being 80 feet long and 10 feet high.

The signals of 5GP have been heard in 36 states and two Canadian provinces. The greatest distance worked to date is 2100 miles. Being an Official Relay Station of the A.R.R.L., considerable relay traffic is handled. John McCaa, 1025 Fairmount Ave., Anniston, Ala., is owner and operator.

### LOW-POWER LOOP TRANSMISSION

*(Continued from page 39)*

rigidly there. By this means transmission from an auto in motion is possible. The wire on this, and all our other loops, was No. 18 D.C.C.

The next thing on our program was phone. One of the gang suggested absorption modulation so a coil was rigged up inside the loop consisting of one turn of insulated wire with a high resistance microphone connected to the two ends. (See Fig. 3.)

This worked surprisingly well around the city, and even up to distances of approximately 15 miles we had no difficulty working on voice. This also was very sharp. Due to this sharpness it was easy to work duplex provided a loose coupled receiver was used and separate "A" batteries were used for the receiver and transmitter. We never got around to using Heising modula-

tion but there is no reason why it should not work perfectly.

We did not have sufficient time to work on this so we could not make the exhaustive tests we wanted to, but I will give you some idea of what we have been able to do since with the loop transmitters.

Early last spring I left Pasadena and came to Arizona to work for the U. S. Indian Service. We were in a camp out in the desert and just 400 miles from Pasadena. I managed to get up two 25-foot sticks about 120 feet apart and strung a one-wire aerial. For a ground I buried some tin cans and a kettle, for which the Chink cook almost knifed me, and then the fun began.

My receiver consisted of a single circuit tuner (I only use a single circuit in the desert, not in a city), a detector and two steps of audio frequency amplification. I copied 6BRJ in Pasadena, using a loop

*(Concluded on page 54)*



# INTERNATIONAL Amateur Radio

## French Regulations Recalled

In the October QST it was stated that the French Postal and Telegraph Administration had promulgated a new set of regulations regarding radio. These new regulations were announced and their complete text was published throughout France but they aroused such a storm of protest, particularly on the subject of wave lengths, power, and the amount to be paid the government by broadcasting stations, that they were not officially put into force. A new set of regulations that will be much more favorable for broadcasting, it is believed, is being framed, but it is probable that the rules concerning the amateur will remain about the same.

The granting of call letters to French amateurs has reached the letter "E." There are now, therefore, more than 100 amateurs in France who are authorized to use transmitting apparatus.

## Argentinians to Take Part in Transatlantic Tests

The Transatlantic Tests planned for this winter between Europe and the United States are attracting attention in all corners of the world. A group of South American amateurs have just signified their desire to take part in the tests and try their luck at reaching this country with their transmitters. About twenty stations will transmit, the average power being that obtained from four 50-watt tubes. Their wave lengths will be in the neighborhood of 200 meters and transmission will be mostly by radio telephone, although some will send with a key. The *Revista Telegrafica*, published in Buenos Aires, has charge of the test arrangements at that end.

As this will be their first attempt at real "DX" work, exceptional results are not looked for, especially in the matter of receiving, because it is now the summer season in the southern hemisphere. Next April or May, however, when receiving conditions are better in Argentina, American amateurs will try transmitting to them.

Just a word about the difference in

time between this country and Argentina. The time there is four hours behind G.M.T. This means that eight PM Eastern Standard Time is nine PM in Argentina, and so on.

Now is the time to brush up on your Spanish and prepare to hear the signals of our South American cousins. Watch the weekly A.R.R.L. broadcasts for further information on these tests!

## Will You Take Part?

Even at this date it is not too early to begin planning for next summer's Pan-American tests. If interested, drop a post card to F. H. Schnell, A.R.R.L. Traffic Manager, 1045 Main St., Hartford, and signify your willingness to participate. State what power you intend to use and be sure and say to what extent you are familiar with the Spanish language. Let's go!

## Amateur Radio Getting Started in Brazil

"The main event in amateur radio in Brazil during the past year has been the formation of the 'Radio Society of Brazil' which has for its main object, although not the sole one, the furtherance of amateur radio. In a country where any form of radio is new, it is exceedingly difficult to cultivate amateur radio in these times without going through the broadcast stages first. It is now a simple matter to obtain a receiving license whereas a few months ago it was a very complicated matter, showing that the efforts of our organization are bearing fruit. Some new radio regulations are being framed and the Radio Society has made recommendations to the governmental committee regarding them. We have been assured that these recommendations will be carefully considered.

"Our eagerness to get on the air has brought about the condition that if you twist your dials carefully you will hear quite a few chirps around town. The results remind me of the early pre-war days; I found one on 950 meters!

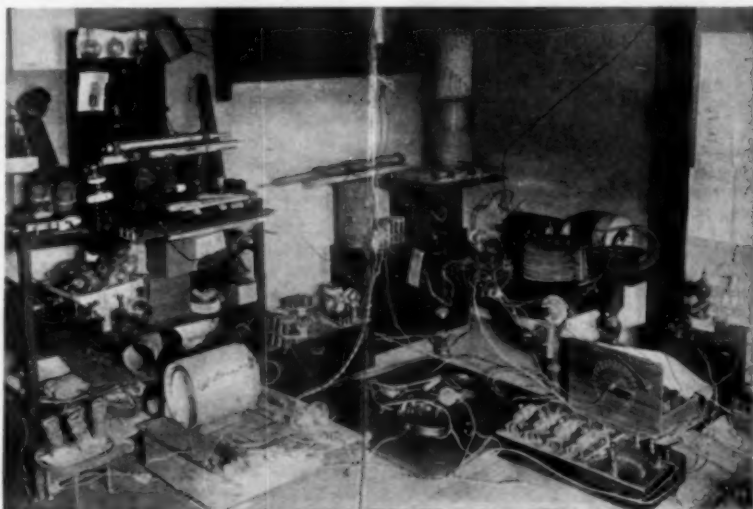
"The amateurs here are only now starting to build short wave receivers so we cannot report any of your calls yet. Our test for DX is Buenos Aires, about 1500

miles to the south, where there are three or four broadcasting stations. One of these a 500-watt set, is consistently heard in Rio de Janeiro on a regenerative detector alone. Perhaps this does not sound exceptional, but it must be remembered that static down here will deafen you with one step of audio. There are two or three super-heterodyne sets and several employing radio amplification in use here, and they seem to be the best solution."

Mr. C. G. Lacombe, Cosme Velho 105, Rio de Janeiro, Brazil, a member of the A.R.R.L., has given us the above interesting insight into the radio outlook in Brazil.

ranged a series of special tests with British 2SH which took place the first part of December. His station JFWA, transmitted from 8:00 to 8:30 P.M. Tokyo time, using one kilowatt of C.W. power with a wave length of 300 meters. Pacific coast amateurs stood a good chance of hearing him, but nothing in the way of results has been reported yet.

The status of the radio amateur in Japan is very unsatisfactory. No licenses are issued for the operation of amateur stations and JFWA is the only licensed private experimental station, except for those belonging to the various radio companies.



JFWA, Station of Mr. Hiroshi Ando, Tokyo, Japan

Just as soon as conditions permit, he, as well as several others, are planning to install good C.W. stations. The Brazilian amateurs no doubt will be a strong link in a future Pan-American relay route and we wish them the best of luck in getting started.

#### Japanese Experimenter Hears U. S. Hams

The American amateur hurled his signals into another far-off land recently when Mr. Hiroshi Ando, Japan's foremost radio experimenter, in company with several of his associates, listened to the signals of fourteen U. S. amateur stations. The complete list was reproduced in the Calls Heard section of the last QST and includes prominent stations in the first, second, fourth, sixth, seventh and ninth districts. An eight-tube receiver somewhat like a super-heterodyne but of a special type developed by Mr. Ando was used to accomplish this record reception.

So interested is Mr. Ando in amateur long distance communication that he ar-


Many an ambitious amateur comes to Mr. Ando's laboratories, carrying his transmitting equipment with him in order that he may test and experiment under the licensed call of JFWA.

Despite the restrictions, there are around 500 amateurs in Japan. They work on wavelengths from 200 to 400 meters generally and use either a spark coil transmitter or a hard receiving tube as a C.W. transmitter. No call letters are used and only short distances are covered. The record transmission of 30 miles is held by 19-year-old Viscount Doi, using a C.W. transmitter of less than 5 watts.

Mr. Ando, who is hearing the signals of American amateurs, is a pioneer radio worker in Japan. He has over fifty patents relating to radio and communication and has written several books on radio, thus ranking both as an inventor and a scholar. His well-equipped "Institute of Radio Research" is the only one of its type in the

(Concluded on page 54)

# Strays



## WARNING

The device pictured herein is the registered trade-mark of the American Radio Relay League. The design of the same is also the subject of a design patent covering its use as an association emblem. Permission is given A.R.R.L. members in good standing, and clubs affiliated with the A.R.R.L., to print, wear and display this device in connection with non-commercial amateur activities. Its use by other persons, or for other purposes, is prohibited under penalty of law, except by special arrangement with the proprietors.

*K. B. Warner, Secretary.*



Where have all the fellows gone who used to be interested in the reception of long-wave foreign stations? Let's hear from you. How is radio frequency amplification, etc., working out on these waves?

J. D. Blitch, 41S, Statesboro, Ga., was the "4" who appeared in the photo "All Districts and France and Canada at the Convention," printed on page 12 of the November QST. He'll be on with 100 watts right after the first of the year.

Every other day or so the postman brings in a package containing a dial, a variable condenser or other piece of apparatus addressed to Willie Jones, care of the A.R.R.L., Hartford, Conn. This is the result of Willie's writing to manufacturers on A.R.R.L. stationery and not giving his return address. Be careful about this, fellows; it will help you get replies to your letters.

## A Real Amateur Amplifier

Karl Hassel's excellent article in the December issue suggests (page 40) that we need an audio transformer with a very high ratio of turns and with a very bad (seen from the music standpoint) distortion curve. We hope that someone will soon start to make a 15/1 transformer but in the meantime we can roll our own according to the formula devised by Larry Dunnam of old 3ZY. Here 'tis:

Take an ordinary Phoard coil and pull

out the primary, then rewind with 4 layers of No. 30 double silk or at least single cotton wire (n. d. on the enamel—it punctures). Then put the secondaries on and connect them up again. You now have an audio transformer that will make broadcast music sound like the wrath of heaven or a \$5 phonograph but—the way it boosts C.W. signals leaves nothing to be desired. Repeatedly Larry was able to feed a nicely readable signal into one stage of this sort of affair and get out of it a noise that ran the gang out of the place. Incidentally this transformer has such a peaked curve that bum 60-cycle plate grumbles do not get thru it to speak of and only the beat note is amplified strongly. We understand that there were later patterns of the Ford-Dunnam transformer which had a closed core but we never saw these.

Let us know how this works with you.

When your license says "local standard time" it means the U. S. standard time of your region. Remember this and don't go off the reservation about the kind of "local" time that your village council or state legislature manufactures for home consumption. The license had better say "Standard Time" and cut out the word local—then all hands would understand what was meant.

## Special Notice to Hardshells

All you birds who think (as in 1905) that the best amateur wave is 200-meters-plus-whatever-you-can-get-by-with are invited to do a bit of listening to the weekly 125 meter broadcast from 5XV at 10:30 Saturday nights. Of course you will have to can that commercial tuner and get an amateur one, also you will have to learn to tune, for 5XV is a real C.W. station, storage battery plate supply.

After your ears have recovered, tune on down to the waves used by 8XK and 9XW (about 90 meters) and hear the strongest signal you ever read about.

P.S.—Good series condensers for sending sets can now be bought.

Foreign amateurs and ship operators



sending in lists of calls heard for that department of QST will be doing everyone a great favor by making separate lists for the amateurs of different nationalities. If you do not know the nationality of a station, please so list it, for it is getting to be very difficult to place the credit for a good record. Thanks.

#### Dead Spots

We would like to have all possible information about any dead spots of which any reader can tell us. Sit down and think over the places you cannot hear—or the places you cannot work into. When writing us please give all the possible information, whether it's spark or tube signals that do not get into (or out of) the place in question, how different waves act, whether the time of day and the season of the year has anything to do with it—every possible thing. Let's have a REAL response on this—several thousand letters.

—Tech. Ed.

In the story of the Second National convention in our November issue, in mentioning the receiving sets drawn for as special prizes, we inadvertently omitted the fact that the Western Coil & Electrical Co., of Racine, Wis., very kindly gave one of their WC-5-SW sets, a special 4-tube radio-frequency set designed for short waves with a range from 80 to 300 meters. Ralph E. Brooks of Hammond, Ind., was the lucky winner of this set.

#### Doctor Is Summoned by Amateur Radio

Probably through the summoning of medical aid by amateur radio, a woman and a little baby in the isolated village of Selkirk, 150 miles northwest of Winnipeg, are alive today. It was in early November that station 4AG at Selkirk was called upon to try and get a message through to Winnipeg, calling for a doctor. The operator at 4AG tried for two nights to put the message through but was unsuccessful. On the third evening he got into communication with 9EBT, owned by Harry Drew of Fargo, North Dakota, and gave him the radiogram asking for aid. Mr. Drew immediately wired it to the owners of the Selkirk mine at Winnipeg and a doctor was dispatched to the village. Several days later a letter of sincere gratitude was received by 9EBT for the great help his station had been.

Thus the value of amateur radio in emergencies has again been proven!

7IT is not an Alaskan station, but is located at Stevensville, Montana, and has been operated for the past year by Ashley C. Dixon. This is the station that Mix on WNP has been hearing. Roy Anderson's station at Ketchikan, Alaska, which formerly had 7IT for its call, has not been in operation for a long time.

We continue not to have a description of 3JJ—but hope still breathes feebly.

#### Improvements in the "Superdyne"

A tremendous number of inquiries for details on the construction of the "Superdyne" have been received by QST and by the C. D. Tuska Co. since the publication of the article on this subject in the November issue. The Tuska Co. is not interested in the sale of parts and our own interest was solely in putting basic information before the readers from which to work—we did not, and still do not, see the call for detailed dimensional drawings and the like.

We are therefore pleased to inform the reader that the Tuska Co. has issued a booklet about the Superdyne, giving dimensions, some changes in the circuit, and detailed operating instructions and advice as to choice of parts and their arrangement. This booklet may be obtained by addressing the C. D. Tuska Co. at 83 Homestead Avenue, Hartford, Conn. The price of the booklet is 50 cents.

Mr. Harry C. Gawler, formerly Radio Inspector for the first district and recently with the Radio Corporation, has now joined the General Radio Company organization in the capacity of Sales Promotion Manager. He has been in radio since 1904 and is a true friend of the amateur. We wish him every success in his new work.

The final decision in the suit of the C. F. Burgess Laboratories and the Burgess Battery Company against the French Battery and Carbon Company of Madison, Wisconsin, has been made in favor of the Burgess Companies. The court held that trade secrets and inventions of the Laboratories were wrongfully procured and appropriated to the use and benefit of the French Company. This suit was started in June of 1921 and probably has established a record for the Wisconsin Courts in the volume of testimony introduced.

The Acme Apparatus Company of Cambridge, Mass., will upon request, supply the owners of their transformers with a sheet showing the complete terminal data for all of their models of mounted and unmounted transformers. This will help the many amateurs who have written us for the information.

Regarding the stray in the December QST about tapping a Zenith tuner for 100 meter stuff, the total length of wire in use when tapped at the tenth turn will be about 15 feet, not 70 feet as there mentioned.

# Who's Who in AMATEUR WIRELESS

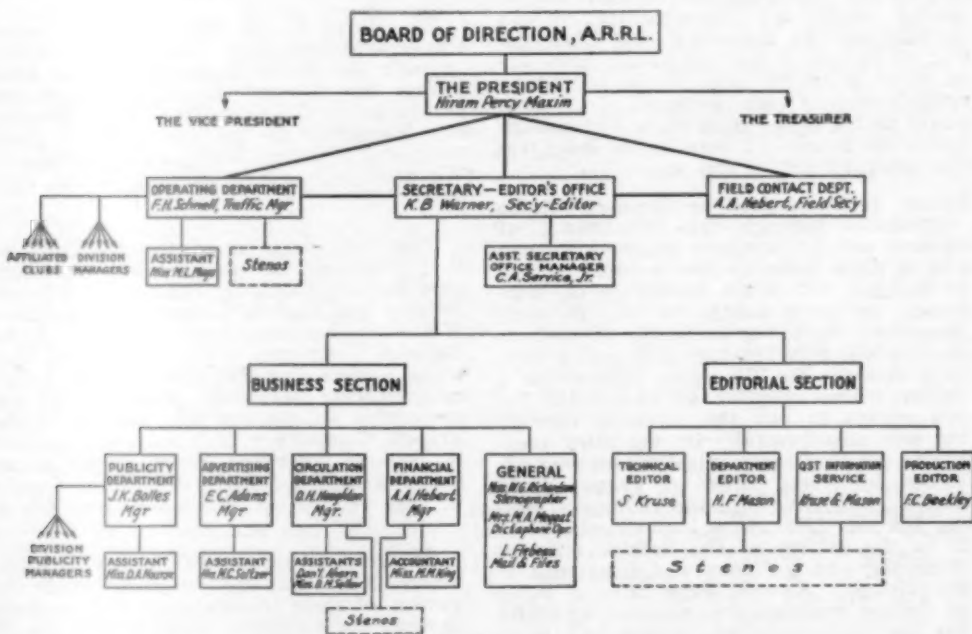


## The Crew at 1045 Main Street

*A Few Close-Ups of the A.R.R.L. Headquarters Staff, and  
How They Spend Their Time.*

SO many requests have come in asking us to write a sketch on our Headquarters Gang and introduce ourselves better to our A.R.R.L. membership, and so many visitors have expressed surprise at

ing in Hartford. He was the only employee. By the end of the first week he decided that he simply had to have some help, and a young man stenographer, now no longer with us, was engaged—even if



the ramifications of our activities and the number of us here, that we have been more than half convinced that it may be helpful. This story is accordingly inflicted upon a patient membership.

The post-war headquarters of the League were opened by the Secretary-Editor in May of 1919 in a couple of dingy and ill-lighted little rooms in an old office build-

nobody knew where the money was coming from to pay him. In December of that year Mr. Adams, now our advertising manager, joined our staff as the Secretary's assistant; the next spring Peggie King came in as a stenographer, fresh from a high-school commercial course, and the following fall the Traffic Manager was made a member of the Headquarters office and Mr. Schnell

came to Hartford. By the spring of 1921 we had outgrown our quarters and with the need for more deskroom, we moved to the present site at 1045 Main St., Hartford. At first we had only a couple of rooms, but our needs increased and we grew bit by bit until now we occupy the entire third floor of our building. It isn't much of a building, but we have plenty of floor space at a rent we can afford, and the general arrangement is well calculated for the turning out of huge quantities of hard work. From the very start the history of our League's office has been one of expansion and development, with new and varied work constantly being undertaken and existing work developing to huge proportions, so that we have had a constantly growing and shifting personnel as new departments were created, promotions made, and additions made to the staff. There are now a total of nineteen of us. The wiring diagram herewith is a hook-up showing how we fit into the A.R.R.L. scheme of things and how our duties and responsibilities are divided.

Ours is no mahogany suite with green rugs and gold-plated cuspidors (that always has been our idea of luxury). But we have a happy, congenial crowd of people who are intensely interested in their work, and in our daily business lives we are more like one big family than a business office. We believe that we can be happy in our work and still get things done. Each week a terrific quantity of mail enters and leaves our office; bulletins from the Publicity Department and the Operating Department, thousands of letters relating to every phase of the League's business; and once a month we turn out an issue of *QST*, which, believe us, means that quite a bit of work has been done by somebody.

Now, rapidly, one by one, we want to present ourselves to you and tell you what we do up here.

Strictly speaking, Daddy Maxim, our A.R.R.L. President, is not a member of the Headquarters Staff—he has his own business, which is Maxim Silencers. But he is a very frequent visitor at 1045 Main Street, where we save up our hard problems for him. He solves those problems, gives us always a fresh viewpoint, and fills us anew with courage and ideas. It is his duty as president to keep a watchful eye on all our activities, and in the process he is our constant inspiration. On the air he is 1AW, which has been heard everywhere from Japan to Holland.



Hiram Percy Maxim

#### The Secretary-Editor's Office

K. B. Warner, 1BHW, is the League's Secretary, the editor and general manager of *QST*, and the official custodian of the Wouff-Hong. Most of his time is given



Kenneth B. Warner

over to a general supervision of League work and the personal handling of many of the more important League affairs. He runs around the country collecting gray hairs and a furrowed brow in the study of League policies, and at home he directs the work of his staff in turning out *QST*, getting League publicity, keeping records, and handling the general correspondence of the League in the service of its membership. He is an ex-Illinoisian, by the way, a pre-war 9.

Chas. A. Service, Jr., "CS" at 1CKP and ex-3ZA, is the Assistant Secretary and right-hand-man to K.B.W. He has had good training for this position as former vice-president of the League and Manager of the Atlantic Division. At headquarters he handles the bulk of the secretarial correspondence, particularly our foreign mail, which is now very sizable and immensely interesting. He's the office manager, hires and fires the girls, and pays us our weekly stint. Whenever the office isn't warm enough, or somebody's stenographer doesn't show up, or a letter can't be found, Charles is it. He is a Penn U. man, '16, and a Zeta Psi.



Chas. A. Service, Jr.

#### The Operating Department

Is there anybody who hasn't met Fred



F. H. Schnell

Schnell in the three years he has been A.R.R.L. Traffic Manager? Here is the Chief of the Brass-Pounders, the leader of the Boiled Owls. Schnell was a Chicagoan before coming to Hartford; it was his notable success as Chicago City Manager of the O.D. in the application of the Chicago Plan that first brought him to the notice of the A. R. R. L. Board. He is one of the best amateur operators in the country, knows his stuff, and is a peach

of a fellow. Can we say more? Oh, yes—1MO.

How many of you fellows knew that there was an assistant Traffic Manager? Yes sir—yes ma'am, we mean. Margaret ("Peg") L. Mays knows more about O.D. details than Schnell does, and for a very good reason—she handles them daily. She is the "MLM" you fellows see on O.D. bulletins; she keeps the files and records in the traffic office, and in general is FS's right bower. She lives in Waterbury—we

don't know why—and commutes.

P.S.: We've just found out why she lives in Waterbury. She has just become Mrs. A. L. Sage. So scratch her off your list of possibilities.

#### "The Hebert Department"

A. A. Hebert has so many jobs around here that he rates a department all his own. Besides being the Hon. Treasurer of our A.R.R.L. the watch-dog of our finances, he is the traveling representative of the headquarters office for helping clubs, making visits, attending conventions, etc., and he also supervises credits and collections in our financial department. Mr. Hebert has been a member of the A.R.R.L. Board since its national organization, and was our original General Manager and vice-president.

Before coming to Hartford he was president of the Second District Executive Council and operated 2MP. He is now "AH" at 1CKP.

#### The Editorial Department

S. Kruse, our technical editor, is the chief technician at Headquarters. Kruse is a Kansan, hailing from Lawrence, where he graduated from the University of Kansas. He was one of the ring-leaders in pre-war amateur activity in the Mississippi Valley; during the war he instructed in the Signal Corps radio school at City College in New York; later he was an assistant engineer at the

Radio Laboratory of the Bureau of Stand-

ards, where among other things, he handled lots of the work in connection with the Fading Tests; then he had a year as radio engineer with the Hammond Radio Research Laboratories; then back to his first love, the amateur game, with QST, where he writes articles in an unusually graphic style, edits other folks' articles, runs tests, and carries on a terrific correspondence. Kruse has been connected with more radio calls than most of us: prewar 9LQ, 9BM and 9XP; five different stations under the call WWV, NSJ-2, KDSU and KDYH (Hammond research), 3XK, 3ABI, 9KW, and at the present time 10A, 1HX and 1XAQ. Is it any wonder he knows something about amateur radio?

Howard F. Mason came all the way from Seattle to give us the help of a western amateur in the preparation of QST. He is the editor of the regular departments in QST, the official "question-answerer," and, with Kruse, joint proprietor of our new "experimenter" work. Mason and Kruse between them conduct our "Information Service" to A.R.R.L. members, and you'd be surprised at the volume of correspondence they handle. When these two fellows get to dictating, each talking at high speed to a dictaphone, the ether around 1045 Main gets blue and wailing and gnashing of teeth is heard from the direction of the stenographers.

Mason used to be 7BK; we robbed the Operating Dept. when we brought him to Hq., for he was then Manager of the Northwestern Division, as well as secretary of the Seattle Section of the I. R. E.

Here's the chap who actually "makes" QST: F. C. Beekley, our assistant editor in charge of production. Each month



F. C. Beekley

Beekley has hundreds of pages of "copy" shot at him, and from these he must have type set up and cuts prepared, then he wades thru yards and yards of proof-reading. When everything is in readiness he makes a big scrapbook from this material, under the direction of the editor, showing the location of every article and every ad. Then he breaks

camp and moves down to the printer's with a nice sharp stick—for the issue must be got out on time and that is "Beek's" job.



Mrs. A. L. Sage



Arthur A. Hebert



Howard F. Mason



S. Kruse



## A Few Glimpses Around A.R.R.L. Headquarters



*The Circulation Department*



*The Editorial & Publicity Departments*



*The Traffic Manager's Office*



*The Secretary-Editor's Office*



*A Corner of the General Office*



*The Advertising Department*



It is at the same time the most fascinating job and one of the most difficult ones around the place. In-between-times he is 1WC and 1AEL—yes, it takes a ham to read proof on QST.

#### The Advertising Department

Edwin C. Adams, our advertising manager, is in point of service our oldest A.R.R.L. man except the Secretary. Heaven only knows what jobs Ed hasn't done around here in the dim years now past, but for the last couple of years he has been in charge of our advertising exclusively. He



Edwin C. Adams

is a perfect example of the possibility of making a real A.R.R.L. man out of a fellow who starts with no more than an Army knowledge of the Continental code. It is the advertising department which brings in the business which pays our bills and enables the League to carry on, so Adams is one of the main-springs around here. He is a New York University man, a Psi U., and an accomplished linguist. He and Charles Service get all the medals in our office in Arts & Letters. Ed is married and has a fairly new loud-speaker in excellent operating condition.

Assisting Mr. Adams in the advertising department is Mrs. Marie C. Seltzer. She is a New York girl; in fact, she was just Marie Corr when she started at A.R.R.L. but there was a "reason" for her moving to Hartford and his name was Seltzer. She is jolly and capable, and you'd like her. She writes Ed's letters that bring home the bacon, and she's the Big Chief of the Ham-Ads. She



Mrs. Marie C. Seltzer

knows somebody that knows Ethel Barrymore, and her hobby is the theatre.

#### The Publicity Department

The Lord High Potentate of the Royal Order of Inkslingers rejoices in the resounding name of Joshua Kenneth Bolles, but around this dump we call him "Jake" and let it go at that. Jake is manager of the Publicity Department, which not only supplies amateur news direct to hundreds of newspapers but, in the short year that that department has existed in our office, has built up a highly efficient field organization of the fellows interested in the A.R.R.L. publicity movement. This field organ-

ization parallels our Operating Department, with division, state and city officials, looking after and reporting A.R.R.L. news and maintaining scores of radio columns in newspapers across the country. It is Jake who is responsible for the fact that in the past year the A.R.R.L. name and the amateur's accomplishments have been seen everywhere; he is doing a work of which we are proud. He is a Connecticut lad, with considerable newspaper experience. His only vice is the dizzy habit of thinking to himself and then believing he has asked a question out loud. But he's a mean Inkslinger.



J. Kenneth Bolles

The rest of the Publicity Department is Miss Dorothy Nourse, a little girl with sparkling black eyes and a bit of the Gypsy in her temperament. She performs equally well on the typewriter, mimeograph, ukulele, or fudge pan (ask 9RR, he knows). She's the "DAN" the Inkslingers see on their letters, and she keeps their publicity clippings in big scrapbooks. When she hasn't anything else to do she's pawing over the incoming mail looking for a letter from New London—wonder why?



Dorothy A. Nourse

#### The Circulation Department

Dave Houghton is the man who sees that you get your QST after Beekley crawls into the office after a ten-day battle and announces that we are ready to mail—he's the manager of the Circulation Department, with its involved records of members and subscribers, expirations, changes of addresses, and all the business of keeping QST on the newsstands, printing enough copies and yet not too many; and it is his department too which handles all the "A.R.R.L. supplies." It takes a mind with lots of gear-wheels in it to keep track of all these things; when Dave furrows that marble brow you can hear the buzzing. He is a Washingtonian but came to QST from the G.E. works at Lynn. He



David H. Houghton

is an ardent sport fan, plays golf at sunrise with Fred Schnell, and is our leading armchair automobile expert.

Dan Ahern plays solitaire all day long with great gobs of QST stencils, but the chief idea is to keep them from getting shuffled. At mailing time he bosses the crew that sends you your copy, so his life isn't all daisies either. Dan is our sartorial sport and the newest in haberdashery can always be found by a glimpse in the Circulation Department—the photograph with the new lid shows



Daniel E. Ahern

what we mean.

Miss Dorothy M. Sellow keeps the membership records and sends you your Certificate of Membership, besides doing lots of other things. She lives in Cromwell, Conn., and commutes to Hartford. Her chief joys in life are her Willys-Knight car and a certain Cromwell young man, and if all is not well with both of them her day is ruined and the membership certificates are cock-eyed. Fortunately for us everything is going well in Cromwell.



Dorothy M. Sellow

#### The Financial Department

O.M. Hebert has had his inning, but we've more yet in this department—quite a bit more, in fact. The keeper of the strong-box is Miss Margaret King, our accountant and cashier. Peg has been an "A.R.R.L. man" for three years and a half. She is full of laughter and gaiety, and was a regular knock-out at our A.R.R.L. Booth at the First Show of the Second District Council. Her chief hobby is dancing, but she goes to church every Sunday, so she is a good book-keeper and manages to keep her figure(s) straight. It is the Financial Department which gathers in the shekels with which to pay our bills, and there'd be no payday around here if it weren't for Mr. Hebert and Peg.



Margaret M. King

#### General

Mrs. M. A. Meggat is the "MAM" seen at the bottom of so many of the letters from the "Headquarters" office. This capable lady is a Dictaphone operator, and she thrives on "cylinders." She handles the entire dictation of the Editorial and information Departments and that of the Secretary and Assistant Secretary, and then goes around the office looking for more to do. We've seen her desk on a Monday morning looking like a battle field, piled high with records dictated by LQ and MN on Saturday afternoon, but she always comes up smiling.



Mrs. M. A. Meggat

Miss Winifred Richardson is the stenographer for the Operating Department and the Circulation Department. She is so quiet that we don't know much about her, but she was born in England, is an accomplished musician, has pretty bobbed hair, and her hobbies are tennis and amateur theatricals.



Winifred Richardson

And now, ladies and gentlemen, permit us: the Sheik of High Street, Lawrence, our office boy. For pure catch-as-catch-can and fancy lady-killing, Larry can't be beat. And he's a real scrapper, too—came in with a black eye the other day. (No particulars available on the other fellow.) He handles our mail both inbound and outbound, including great stacks of circular stuff from the O.D. and the Publicity Dept., runs the general files, lends a hand everywhere, and does the million and one things that nobody else does. The amount of work Larry does per day hereabouts is a standard for the rest of us to shoot at.



Lawrence G. Flebow

#### About Writing to Us

This is a good place for us to say a word to you about writing letters to us. You can see how our office is divided into departments, each handling a section of the League's work. Please don't write about

a variety of things in the same letter; don't ask technical questions in letters renewing your membership; don't incorporate Calls Heard in a letter to the Traffic Manager; don't ask for an O.R.S. appointment in a letter which orders some back copies—please write separate letters about separate topics, so you can be served at one time by all the League's departments. It is not necessary to address individuals or to try to figure out what department it goes to—that's our worry: just address your letters to the A.R.R.L. at 1045 Main Street.

#### The Glad Hand

What do you think of your A.R.R.L. Headquarters? We'll bet you had no idea it was as big an institution as it is. Now when you come by Hartford, O.M., drop up and see us—it's a much more satisfactory way of getting acquainted than via a magazine article. You'll find us hard at work but we've always got time to chew the rag with A.R.R.L. members. We'll be glad to show you around the place and to learn the amateur gossip from your home town. The latch-string is always out at 1045 Main Street.

—K.B.W.

Photos of Messrs. Maxim, Schnell, and Warner, by Bacharach; of Mr. Adams by Blackmore, Hartford.

#### INTERNATIONAL AMATEUR RADIO

(Concluded from page 45)

country and has been granted an almost unlimited transmitting license. His signals, when using 500 watts of C.W., have been heard by Japanese ships 3000 miles at sea.

He invites letters from members of the A.R.R.L. Mail should be addressed to Mr. Hiroshi Ando, 13 Kitaiga-cho, Yotsuya, Tokyo, Japan. In the past many letters to him must have gone astray in the huge quakes and subsequent fires that swept Japan but, with that danger past, letters should reach him more promptly.

It is hoped that in the very near future JFWA can maintain two-way communication with American radio amateurs. Considering what has already been done, in reaching Australia and New Zealand, communication with Japan should not present any new difficulties. The air line distance from Seattle to Japan is no more than from Baltimore to Hawaii, and the distance from Hartford to Japan, across the center of Alaska, is hardly as far as from Los Angeles to New Zealand. JFWA is hearing our signals and he is the first station on the other side of the Pacific to come forward with a good-sized tube transmitter for the purpose of establishing two-way communication across the Pacific. Before many moons someone on this side is going to hear him.

#### NEW ZEALAND BEDLAM OF YANKEE SIGNALS

(Concluded from page 39)

good night, but now there are often several copyable stations going at once.

To return to the Trans-Pacific tests—I am afraid the N.Z. stations won't burn out any phone leads in U.S.A. when they start replying. We did not know until the tests had almost commenced that we were expected to participate, and none of us have stations above the 50-watt input limit. The majority use one or two five-watters and no one possesses tubes of higher power. However no doubt a few of our fellows will obtain permission to use about 100 watts input and, with three or more amperes in the aerial, should stand a good chance of reaching Hawaii. Over in Australia I believe they are fitting up several high-power sets which we all hope will succeed in reaching the Pacific Coast.

(Two unconfirmed reports have reached us of the reception of Australian amateur signals in California. Wonderful news if true. Details later.—Ed.)

#### LOW-POWER LOOP TRANSMISSION

(Concluded from page 43)

aerial with my circuit, on *fone* for several nights and copied his C.W. signals a half an hour after the sun rose one morning.

He was using a 6-foot barrel loop with 4 turns of wire on it and with one turn of wire inside the loop for absorption modulation. The tube was a five-watter with 450 volts on the plate. He had no outside aerial up at the time. The loop was at ground level. It might be well to mention here that the loop should be as close to the transmitter as possible. Long leads are not conducive to high efficiency.

Later in the spring I kept two Indian Service camps in communication for a short while using a 4-foot loop and a five-watt transmitter with 350 volts of "B" batteries on the plate. The *entire* layout was in a 10 x 10 tent. The set at the other end was a regular five-watt transmitter with an outdoor aerial and a receiver similar to the one previously described. These stations, by the way, were 35 miles apart.

Most of our first experiments were conducted in the laboratory of Mr. Samuel McMeen and have been mentioned in an article by him which appeared in *Radio* for May, 1923. (See page 18 of that issue.)

Has anybody some bright ideas for QST covers? Not finished drawings, you understand, but ideas around which 8ZZ can draw a cover.



# The Junior Operator

## GETTING ON THE AIR

The Eighth of a Series of Articles of Helpfulness and Practical Value to Those Just Entering the Amateur Radio Game

By H. F. Mason, Department Editor.

**B**EFORE the embryo amateur has gone far he will have begun to make plans for his future station. Much helpful information can be obtained at this point by talking with other amateurs and visiting their stations. Even so, there is a chance of some wrong impressions being created and a little well placed information at the start will help the coming amateur much more than a jumble of miscellaneous ideas picked up here and there.

No set of rules can be given for building and arranging an amateur station. The tendencies of the owner, whether he be interested in relaying or from the experimental standpoint, will show greatly in the arrangement of his station. A relay man prefers a rather small room with no apparatus in sight except that actually in use. The experimenter type of amateur likes plenty of room with large tables and all kinds of radio apparatus at hand that can be pressed into service at a moment's notice to assist in carrying out some experiment. The experimenter, as well as the relay man, however, must know the code well and be able to carry on two-way communication with other stations in order to check up on the results of his experiments.

Amateur stations are of two types; neatly arranged stations and "haywire" stations. The class under which your own station comes can be determined only by you. The money you have spent on your station or the amount of apparatus you

own has nothing to do with it. It is only by carefully planning and paying attention to the details that you can put your station in the neat appearing class from the very first and keep it there. This may be difficult to do but you will be repaid eventually, for neatness goes hand in hand with efficiency.

### General Arrangement of Station

As stated above, the building of your station cannot be governed by any definite set of rules. Many amateurs have learned through years of experience, however, that there are several points, that must be attended to if complete satisfaction is to be had.

If the station be a relay station, or if a considerable amount of relay work is done, it is very desirable

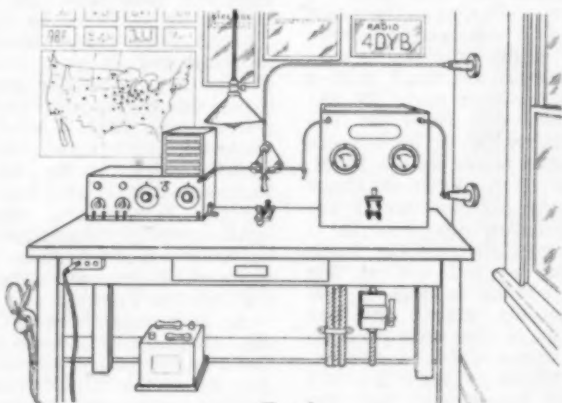


Fig. 1

that all apparatus, and especially the switches and tuning controls most frequently used, be within comfortable reach of the operator. Fig. 1, which is intended to represent a typical amateur station, will make this more clear. The receiver is located on the left and about sixteen inches back so the operator can rest his arms on the table while making the tuning adjustments. When doing the final tuning with his left hand he can copy the station with the pencil in his right without discomfort. When he desires to transmit he throws the send-receive switch which is mounted on the wall or table as near the transmitting key as possible. Very little time is then lost in making the change between the sending and receiving posi-

tions. The hand key should be mounted with the center of the key knob between sixteen and eighteen inches from the edge of the table, on a line with the operator's right shoulder, for the most comfortable operation.

The radio table itself is an important item. Without question the best kind would be a nicely finished and sturdy hardwood table. Unfortunately, however, such tables are not usually given to radio amateurs to bore holes in and fasten apparatus to, so we have to recommend anything that is handy and can be used for the purpose. The table should be solid and strong. A few coats of varnish will improve its looks wonderfully. Above all, be sure that the top is thirty inches from the floor. This is a standard height and even small variations from it will be noticeable. These same remarks apply in the case of a built-in radio table.

#### Installing the Receiver

Be sure to make a nice job of running the wires to the binding posts on your receiver. Loose wires running everywhere and in every direction do not make a good-looking station. Perhaps the best wire to use is heavy silk-covered lamp cord of some dark color, with each wire cut to the exact length required and a lug neatly soldered on each end. If the binding posts are on the front of the set, and it is not desirable to bore holes for battery and ground wires in the table, it is well to run a strip of wood about  $\frac{1}{4}$  inch square around the bottom of the receiver with holes bored edgewise in it below each binding post to take the leads. The wires can then be led out at the rear of the set as shown in Fig. 2. A small moulded bushing placed in the wooden strip where each wire goes through it will add to the appearance of the installation. These bushings may be had from any electrical dealer and are the kind used where a piece of lamp cord enters the metal socket of a drop light. The receiver is then fastened to the oblong framework beneath it and to the table by brass angle-pieces.

The B batteries should be located near the receiver. Fastening them to the under side of the table or to the wall beneath the table with straps made of brass strip about  $\frac{1}{4}$  inch wide and  $\frac{1}{8}$  inch thick is perhaps the best method. The storage battery sits on the floor beneath the radio table. A lead-lined tray should be provided to prevent any acid from creeping out of the battery and getting on the carpet. Some form of battery charger will be around the station, and if the amateur desires the very latest he can build a small panel with a battery charge-discharge switch, an ammeter and a switch

for turning on and off the rectifier. This panel can then be installed near the battery in the radio room.

There are sure to be visitors at your station at one time or another and on these occasions it is very handy to have several pairs of phones on hand as well as a permanent means of connecting them in the circuit. A small box with several double telephone jacks connected in series in it and the whole secured to the under side of the table is about the best solution. A separate plug is used for shifting the phones from one stage of amplification to another if the receiver is designed so this can be done.

Another innovation that will help improve the neatness of the station is to have a hook for the phones and to keep them hanging on it when not in use. After all, neatness consists of little more than having a place for everything and keeping everything in its place.

#### Power Wiring to the Transmitter

The first thing to do regarding the supplying of power to your transmitter is to go to the office of the local electric light company and talk the matter over with them. Be prepared to tell them how much current your transmitter will draw from the line and to give other details. They will be able to advise you as to just what is necessary in your particular case. In general, the wiring must be put in in accordance with the "National Electrical Code" which is the Regulations of the National Board of Fire Underwriters for Electric Wiring and Apparatus. Electric light companies have rules that must also be followed in addition to this code, however, so no accurate data can be given that will always apply.

As a general idea of what is required, one company requires a separate line from the regular house meter to the radio set, run in either "BX" (armored cable) or conduit, with an independent fuse block at the meter distribution box and an enclosed switch at the outlet in the radio room for cases where the power drawn does not exceed 250 watts. For larger powered sets, a separate pole transformer with a separate service for the radio set is required. A nominal rental charge must be paid for the use of this extra pole transformer in addition to the cost of the power used.

The information in the above paragraph will serve as a rough guide only; get the exact information from your light company as it will vary in different cities. If you are familiar with wiring methods and if running a separate lead to the meter is all that is required, perhaps you can do the job yourself in an approved fashion. Otherwise, get a certified electrician

(Continued on page 57)

(Continued from page 56)

to install the wiring for you. In every case, however, the wiring will need to be inspected and approved. A copy of the 1923 "National Electrical Code" may be obtained by writing the National Board of Fire Underwriters at either 207 East Ohio Street, Chicago, Ill., or 26 City Hall Place, New York City, N. Y.

### The Transmitter

An amateur builds a transmitting set by buying some parts, making others, and assembling them himself. They can be assembled behind a panel, with the meters and switches mounted on the front of the panel; or the apparatus can be spread out on a table or breadboard somewhat as in a diagram. It is hardly possible to assemble a C.W. transmitter and have it perform at its maximum efficiency at once. Some experimenting with different circuits, different values and kinds of condensers and inductances, will be necessary. For this reason it is strongly advised that your first transmitting set be not built up behind a panel, but that it be of the breadboard style which permits changes to be made more easily. Then when you have the set working satisfactorily it can be built up in panel-style if desired.

Good illustrations of transmitters of the breadboard style are shown on page 7 of the October, 1923, QST and in the Transatlantic Communication in this issue. Ideas can also be had from the "Amateur Stations" department of past issues of QST.

It is not possible to go into detail here regarding the construction of transmitting sets but a few points to watch can be mentioned. Keep the high voltage supply leads as far away from everything as possible. Be sure that all wiring is firmly supported so it cannot fall against other wires and cause trouble. Make the wires large enough to carry the current; the filament circuits should be wired with copper strip for the larger tubes or with copper wire not smaller than No. 14 for the 5-watt tubes. Arrange the set so the meters and tubes are within plain sight of the operator at all times. Keep all power, radio frequency, and high voltage wiring away from the receiving set, insofar as possible. Arrange the wiring in a neat manner and make a good job of the connections.

Figure 1 illustrates some of these points. The main power for the transmitter comes up from the basement to the enclosed switch under the right hand side of the table. The leads from the transmitter to the motor-generator or rectifier, which is also located below, run down through the floor next the enclosed switch. Thus all power wiring is kept away from the receiver.

The purpose of the switch mounted on the wall above the key is to switch the antenna from the transmitter to the receiver. The ground post on the receiver is permanently connected to the ground and the counterpoise post of the transmitter is connected directly to the counterpoise. It is very convenient to have contacts on the send-receive switch to heat the filaments of the transmitting tube when this switch is thrown to the transmitting position and to close the B battery circuit when it is in the receiving position. All changes are then made in one motion. Otherwise separate switches must be provided.

Many amateurs use a separate one-wire antenna for receiving. In this case the transmitter should preferably be disconnected from its antenna when receiving on the single wire as otherwise receiving will not be so good on the wave the transmitter is tuned to. The receiving antenna should be grounded when transmitting.

The best material for the leads carrying the current from the transmitter to the en-

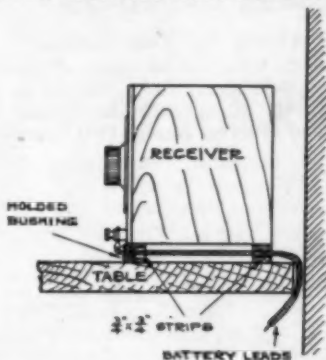


Fig. 2.

tering insulators is copper tubing about  $\frac{1}{4}$  inch in diameter. It will hold its shape and, when polished, adds considerably to the station's appearance. The entering insulators should be located so the leads connecting to them will be short and direct. The antenna and counterpoise leads should not run parallel, however, and should be as far apart as possible.

### Lightning Protection and the Lead-In

Antenna and counterpoise grounding switches are required by the National Board of Fire Underwriters. Their installations not only puts you right with your insurance company, but protects your station as well. They are a practical necessity throughout the greater part of the country, but in parts where electrical storms never occur they are necessary only to satisfy the requirements.

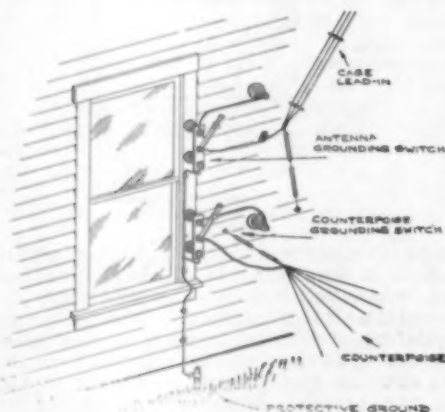
Each of these switches is a double-throw knife switch having a break distance of four inches and a blade not less than one

eighth by one half inch in cross section. All current-carrying parts of this switch must be five inches from the building wall or other conductors and the switch should preferably be located in the most direct line between the lead-in wires and the point where the ground connection is made. The conductor from the switches to the ground connection should be at least as large as the lead-in in current-carrying capacity. The ground wire need not be insulated nor mounted on insulating supports. Fig. 3 shows a typical installation.

The entering insulators, as well of the base of the grounding switches, must be made of some non-absorptive insulating material. The entering insulators must have a creepage distance of at least five inches on each end from the current carrying parts to the wall or other objects. The lead-in wires may be brought through window panes, provided that the five inch creepage distance mentioned above is maintained. For further details on the method of installing the grounding switches, etc. see the "National Electrical Code."

#### Applying for Your License

Coincident with the building of your station you should apply for a license in order to be "all set" to operate the station when your license arrives. Really two licenses are



necessary before you can operate your station; an operator's license, which certifies that you know the code and have a knowledge of radio regulations and radio apparatus; and a station license, which certifies that your station is adjusted in accordance with the radio communication laws with regard to power, wave length, type of apparatus used, etc. There is no charge made for either of these licenses. The first is called the operator's license and the latter the station license. It is unlawful for a station to be operated without a station

license having been obtained beforehand and the station must at all times be in charge of a licensed operator.

A government license and call is required for every transmitting station. Because you only use a spark coil or an amplifier tube with B batteries on the plate and talk with the fellow in the next block is no reason a license is not required. As long as you deliberately transmit signals into the ether a license is necessary.

To apply for your two licenses, write the Supervisor of Radio for the district in which you live, first requesting application forms and examination papers for the operator's license.

A list of the supervisors and their addresses follows:

District	Name	Address
1	Charles C. Kolster	Customhouse, Boston
2	Arthur Batcheller	Customhouse, New York
3	R. Y. Cadmus	Customhouse, Baltimore
4	Walter Van Nostrand, Jr.	Federal Bldg., Atlanta
5	Theodore G. Deiler	Customhouse, New Orleans
6	John F. Dillon	Customhouse, San Francisco
7	O. R. Redfern	2301 L. C. Smith Bldg., Seattle, Wash.
8	S. W. Edwards	Federal Bldg., Detroit
9	E. A. Beane	Federal Bldg., Chicago

If you live within reasonable distance of the office of a Supervisor of Radio, however, it will be necessary for you to go directly to his office to take the examination. The examination questions include drawing a complete diagram of an amateur sending and receiving set, explaining the function of each part. Other questions on radio theory that every amateur should know, besides questions on the main points in the radio regulations, are also included. The code test in which the amateur must show his ability to send and receive messages at the rate of ten words per minute, is part of this examination. If you do not live near a Supervisor's office and take the examination at home, it will be necessary to submit a statement signed by two licensed operators saying that you can send and receive at the rate of ten words per minute and that the answers to your questions are in your own handwriting.

Before applying for an operator's license you should get a copy of "Radio Communication Laws of the United States," obtainable for 15¢ (not in stamps) from the Superintendent of Documents, Government Printing Office, Washington, D. C., and study especially the parts relating to the method of calling, false distress signals, secrecy of messages, and amateur stations and operators.

After you have forwarded your examination papers to the Supervisor of Radio, the operator's license will be forwarded, provided that you have made a satisfactory

(Concluded on page 62)



# Radio Communications by the Amateurs

The Publishers of QST assume no responsibility  
for statements made herein by correspondents



## A Canadian Speaks

Sandy Falls,  
c/o Northern Canada Power, Ltd.,  
Timmins, Northern Ontario.

Dear Eddie:

Re your remarks about the "C.R.R.L." I would like to have the floor for about fifteen minutes. Well, some time ago I sent in for a subscription to a Canadian radio magazine. I've naturally got to help radio over on this side of the line, you know. The second issue on the said subscription arrived today; and the C.R.R.L. stuff makes me sick.

Right here and now, I wish to stand up on both feet as a Canuck and say that it isn't above 15 or 20 minutes ago since Canada sounded like a graveyard on a cold wet night, as far as amateur signals were concerned. I also wish to assert that the present flourishing condition of Canadian amateur radio is mainly if not entirely due to the influence of the A.R.R.L.—Canadian amateur radio was cradled there.

There is no other magazine in the world just like QST, and no other magazine was ever printed that is looked forward to, or read with such avidity by grown men. The kiddie with the picture-paper craze is a bored nonchalant guy in comparison with the "ham" who rocks one of the kids to sleep as he guzzles up the dope from the latest QST. It is, and always has been a never failing spring of information whereat legions of perplexed amateurs with furrowed brows have qualified, and gained enlightenment when the rest of the world was barren. While pettifoggery history is teaching our youngsters that one of his nation can, and always could, lick three of any other nation, the members of the A.R.R.L. are talking with these "foreigners" and they are calling each other "old man," "ole timer" and ejaculating "hi-hi" with gusto. Why, man alive!—the very men whom the nations of the world will ask to be soldiers in the next war are joyously clicking out these terms of endearment nightly across the seven seas,—and shuffle to bed in early morn, whipped for the want of sleep, only to slide into the land of dreams with a prayer on their lips to hasten the coming night; that they may do it all over again.

The A.R.R.L. made all this possible. The pages of QST since 1916 tell a wondrous

story of those patient souls who gloriously failed so many times that the news of having won would oft bring tears.

Hence the world today twists a dial and drops its jaw, bewitched.

As a Canadian I wish to pay my humble respects to the A.R.R.L. and all it stands for. Posterity will mark that organization as the starting point of world camaraderie, and where this "Love-thy-neighbor" stuff got a real foothold in this world of men. I have no patience with such piffle as the C.R.R.L. unless the members fully appreciate the staggering debt they owe to the A.R.R.L. and will accept nothing less than an ironclad affiliation thereto. The hope of a handful of Canadian amateurs (and that's all we will ever be, comparatively speaking) being able to influence legislation is apparently futile, when we view the scars the powerful A.R.R.L. now wears after such combat.

Radio legislation is international in scope—it has to be—and the advent of any magazine or organization which tends to sectionalize the amateurs of any particular nation can do nothing but injury by scattering the economic force of the amateurs. Anyone who has the interests of amateur radio at heart would never attempt such a move, and the instigator of such policy does, in my opinion, stand self-condemned of some ulterior motive.

Possibly the time has come when it would be better to change the name of the A.R. R.L. to the I.R.R.L. (International). Should this come about and any body of Canadian amateurs get together to form a Canadian branch of the I.R.R.L., yours truly will be there with both hands. Otherwise, nix on building a fence around anything, especially when the A.R.R.L. never believed in them.

M. J. Caveney, Canadian 3GG.

## Correcting an Error

Elgin, Ill.

Editor, QST:

On page 64 of your November issue there appears an account of a radio time service at the "temporary observatory on Catalina Island" during the recent eclipse, that perhaps to avoid misunderstanding needs further explanation.

The large observing parties at Catalina

from the Yerkes Observatory, Northwestern University, University of Wisconsin, Drake University and Carleton College were located in one camp known as Camp Wrigley, on the mountain "Summit," some three miles from Avalon.

At the request of Professor E. B. Frost, Director of the Yerkes Observatory Eclipse Expedition, the writer installed a complete radio receiving station at Camp Wrigley for the purpose of receiving radio time signals. The aerial consisted of a single wire 180 feet long and 15 feet above the ground. A 3-circuit regenerative tuner, using honeycomb coils, and two stages of audio frequency amplification were used for the reception of long waves.

Radio time signals were received twice daily direct from Annapolis, NSS. These signals were used by the writer to rate the timepieces of the various expeditions, which consisted of three mean-time ships' watches, furnished by the Elgin National Watch Company, and the chronometers of the Yerkes and Drake observatories. For comparative purposes radio time signals were also received from Pearl Harbor, NPM, Darien, NBA, NPL and NPG. During the eclipse a special series of time signals was received from NPG.

No signals by a telephone line from 6XAD were received at Camp Wrigley.

Frank D. Urie,  
Assistant Director,  
Elgin Observatory.

### Wanted—A Ham in the Azores

Galveston, Tex.

Editor, QST:

Wonder if anyone ever went to the trouble to examine a chart of the N. Atlantic Ocean for the purpose of finding a suitable spot for a 'Relay Central' for European traffic? There is a mighty promising looking place there if you look close enough, and its the Azores; where the NC planes stopped off for chow on their jaunt across the pond.

Here are some figures to show just how likely a location it is. First take the island of Flores, the Westernmost one of the group. Flores is 2,000 miles from New York, 1,400 miles from Halifax, 1,100 miles from St. Johns, N.F., 1,100 miles from Valencia, Ireland, 1,230 miles from Brest, France and 1,275 miles from Lands End, England.

To prove that sigs come thru out that way, heres a list of the most consistent stations copied on April 29th while 200 miles N.N.W. of Flores: 1AR, 1ARY, 1ASI, 1CNI, 1CRE, 1GV, 1SN, 2BMR, 2CEI, 2CQZ, 2RM, 3BG, 3BSS, 3HS, 3JJ, 3TR, 3ZO, 5XA, 8ABX, 8ALF, 8AVD, 8BDA, 8CCO, 8LJ, 8ZW, 9CRV, 9EQ, and Canadian 2BN and 9AL. All copied on detector alone. British and French stations have

been copied over 1,000 miles repeatedly, so a good receiver at Flores or Terceira should melt the cans with sigs from both sides of the pond.

Now comes the flea in the ointment;—who has any data on the generosity of the Portuguese government regarding citizen radio? If it is permissible, and if a real ham can be found there, or one caught caged and carried there, it would change the 'possibility' of Trans Atlantic traffic into a 'certainty'. Come on gang, all ye Knights of Kage and Kounterpoise write to that long forgotten friend or fiancée in the Azores, and get some red hot dope on the restrictions there. Who will be the honored man to unearth another 'Cliff Dow' for the Azores?

Now as to whether the present conoitions, or the proposed Azorean Relay be preferable would seem to admit of some difference of opinion; the answer being according to which is better; the lure of greater accomplishment when two-way communication with Europe is eventually established, or a real Transatlantic traffic route via the Azores. Let us hear your opinions and criticisms as well as any information on existing radio restrictions in the Azores.

F. M. Keefe, "FK."

### Poor Judgment

Roodhouse, Ill

Editor, QST:

I would like to know how these birds get thataway. Here I sit with a message direct from Los Angeles for a town 60 miles away and a bunch of guys down there are calling CQ but won't answer me because I'm not DX enough for their five-watt bottles. And the fellow in Los Angeles is standing by for me to get him an answer.

Here is a chance for the A.R.R.L. to show some speed and the service fell flat just because that bunch down there were too dignified to answer a 500-watt C.W. set 60 miles away because it was too much like local and I have to go back to the fellow in Los Angeles who has been waiting all this time and explain and give the thing up in disgust.

I have a 500-watt set that will work either coast with ease and I am not a bit too good to answer anyone who calls me any time even though he is in the next town for it is a safe bet that he is not going to waste good DX hours on me unless he has something for me and it is a sure thing that I am not going to call him just for the novelty of it.

Now this thing mentioned above not only happened to me but it happens to others in other towns, and I beleive there are lots of messages that have traveled thousands of miles only to die within a few miles of their

destination because someone is too high-browed to work local. What good would our telegraph lines be if they were to place a minimum of 500 miles on each message and not move it at all if it could not be moved at least 500 miles? Think it over. There is hardly a message that does not have to make a short hop somewhere on its way.

A. H. Cain, 9MC (Hen).

### W. E. Tubes

San Francisco, Calif.

Dear Editor:

In the October issue of *QST* I note that you want information on the operation of Western Electric transmitting tubes. The following should help.

The 50-watt tube is known as the "G" or "211-A" tube and fits the regular 50-watt socket; the 250-watt tube is called the "I" or 212-A and fits a special 4-prong socket, all connections coming out the base as in smaller tubes.

The oxide-coated filaments burn at a dull red and have a long life if the rated plate voltage is not exceeded. They are burned at a uniform current which is 3.4 amperes for all 50-watt tubes and 6.25 amperes for all 250-watt tubes. (This is in contrast to General Electric tubes which burn at a uniform voltage but take different currents.) Since the filament resistance of the tubes varies it is necessary to use various voltages and the proper value for each tube is indicated by a letter etched on the glass just after the serial number.

Voltage to be used with "G" tube to give 3.4 amperes.

Code letter on tube	Voltage to be used
A	8.7-9.0
B	9.0-9.25
C	9.25-9.50
D	9.50-9.75
E	9.75-10.00

Voltages to be used on 250-watt "I" tubes to give 6.25 amperes.

Code letter on tube	Voltage to be used
A	10.75-11.00
B	11.00-11.25
C	11.25-11.50
D	11.50-11.75
E	11.75-12.00

Lower voltages can be used in almost all cases.

Use great care in starting these tubes; always turn the filament on and let the tube heat for 5 minutes before applying plate voltage and then use only half of the normal voltage or else put in a high negative grid bias to lower the plate current to half normal. If the full plate voltage is applied to the tube at once, or if the filament is operated at too low a temperature,

a destructive arc will follow, instantly burning out the filament. It is not desirable to turn the tube off while receiving.

The normal plate voltage for the 50-watt tube is 750 volts and for the 250-watt tube 1600 volts. The 50-watt tube can be operated up to about 1100 volts and the 250-watt one to 2100 volts but it is not good judgment to do this; the oxide coating is rapidly removed from the filament by over-voltages and the life of the tube greatly reduced. Attempts to use the enormous over-voltages that tungsten-filament tubes will stand is certain to destroy the W.E. tubes, either by arc-over to the filament or by heating the plate to a point where occluded gases are released and the vacuum ruined. The grids and plates are made of metallic nickel coated with black nickel oxide; thus they are likely to emit gas and even to melt at bright red heats and a special effort must be made to keep the plates cool, not over a very dull red, showing at the center of the plates only.

When the plate voltage is applied a blue glow normally appears inside the tube. This effect is probably present in tungsten-filament tubes also but is blanketed by the intense light of the white-hot tungsten. This is not to be confused with the "blue haze" of a poor vacuum, which fills the entire tube and causes the plate current to rise to enormous values whenever the vacuum is poor, either because the tube is defective or else because the plate has been carelessly overheated. The remedy for this is a new tube.

Western Electric tubes operate well in parallel if the proper precautions are taken as to inter-tube oscillations. If the filaments are to be burned in series care should be taken to use tubes with the same code letter.

When the tubes are old the oxide layer becomes worn off the filament in spots, exposing the red-hot platinum core as a bright spot, which finally burns out with an arc between the ends.

Those having experimental licenses (X calls) may purchase these tubes from the Western Electric Co. under certain restrictions. Before the tubes are supplied the purchaser must sign an agreement to the effect that the tubes are for personal and experimental use only, that they will not be transferred except after written permission is secured from the W.E. Co., and finally that the burned out tubes must be returned and an accounting of work done furnished whenever the Co. asks for it. Detailed information may be obtained from R. M. Hartfield, Public Sales Engineer, American Telegraph and Telephone Co., 195 Broadway, New York City. The list prices at this writing are \$40 and \$110 for the 50- and 250-watt tubes respectively.

—"Prof. Bugs."

### THE POWER LINES IN A DOUBLE ROLE

(Concluded from page 36)

when the tube is not oscillating.—Tech. Ed.)

A peculiarity about this circuit is that as the strength of the oscillations is increased the power-line hum decreases. Also as the wave length increases the hum decreases.

A better circuit than this could not be wanted for a portable receiver—that is, for any place, such as a hotel room, where one can get at an electric light line. Many a time I have wished for such a receiver while traveling. The whole works will fit nicely in a very small suitcase.

### THE JUNIOR OPERATOR

(Concluded from page 58)

mark in the examination. If you failed to pass it will be necessary to wait three months before applying for a re-examination. On the back of the operator's license is the "Oath of Secrecy." This must be sworn to before a notary public and the license returned to the Supervisor of

Radio for his signature before the license becomes valid. You are then a licensed operator and the government recognizes you as a person capable of operating a licensed amateur station in accordance with the radio communication laws at all times.

The next step is to obtain the license for your station. Write or go directly to the Supervisor's office for the application forms. They concern the details of the station, such as the dimensions of the antenna, power and wave-length used, etc. When satisfactorily filled out and the station adjusted in accordance with the regulations the license will be issued, along with a specially assigned official call for your station consisting of the number of your district with two or three letters after it.

The first thing an amateur usually does when he gets his licenses is to have them framed and posted in a prominent place in the radio room. This lets all who enter know that Uncle Sam has given him and his station the official "OK" and the amateur has good reason to be mighty proud of that fact.

Being a real amateur means much more than the mere possession of a license, however. It will take you from three to six months to get the hang of things and able to talk to different stations over the air and handle messages with ease. There are dozens of abbreviations to learn and methods of procedure in sending and receiving that should be followed. Then, too, there are the unwritten rules of courtesy; the "rules of the road" that say that you must not interfere with the work of other stations and should not be an "air hog" but should wait your turn and remember that there are hundreds of stations that have the same rights as you. The article, "Ham Traffic in Any Old Shack" by F. H. Schnell, A.R.R.L. Traffic Manager, on page 31 of the September, 1923 QST\*, will give you many useful pointers on carrying on communication and handling messages.

If there is a radio club in your town, by all means attend it and meet the rest of the amateurs in your vicinity. A radio club serves a very useful purpose in exchanging ideas between its members and cultivating a freindly spirit of co-operation between them. When you have your station in active operation, have joined your local radio club and the A.R.R.L. and are taking an active part in these activities, you can consider your ambition realized—you have become a "dyed-in-the-wool" ham.

[This is the last article of this series. Next month there will appear in this section an article on "How to Handle a Soldering Iron," the first of a series of practical articles on home construction.]

\*Can be obtained from the QST Circulation Dept. at the regular price.

For  
19 years the best  
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# THE BURGESS "A" BATTERY

## Introduces a New Silent Partner



*Notice that: he's exactly my size—same height—same width—same weight. We look like twins. (He's good looking, too.) Look us over.*



**B**URGESS is a big family. I have a lot of brothers. Perhaps the most famous of them is BIG BROTHER "B." He had the field to himself until Burgess introduced VERTICAL "B."

Now comes my new partner. He is VERTICAL "B" JUNIOR. He has the same 22½ volts of pep as the rest of the Burgess "B" family. He is quiet—never talks to himself, and he never lays down on the job.

Burgess calls us "Work-Mates." He ought to know. We are silent partners in your radio entertainment.

Your radio set is no better than your batteries. Without them would be like having a marriage license and no bride. One is no good without the other.

Try it tonight. I'll heat your tube filament while my twin partner takes care of the plate circuit.

*A Laboratory Product*

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FLASHLIGHT • RADIO • IGNITION • TELEPHONE  
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**"ASK ANY RADIO ENGINEER"**

# BURGESS

## RADIO BATTERIES

# Equal to All Demands

THIS IS NUMBER FOUR OF A SERIES

Every tube you add to your receiver makes it just that much more important for you to use Eveready "B" Batteries, for each additional tube increases the work the "B" battery has to do. It demands a more capable, long-lived battery.

Here is a table that shows just what each type of receiving tube draws from your "B" battery. The current is measured in milliamperes, or thousandths of an ampere.

Current (in milliamperes) Taken from the "B" Battery by Various Tubes

"B" Volts	WD-11 WD-12	UV-199 C-299	UV-201 C-301	UV-201-A C-301-A
22½	0.5	0.5	0.5	0.5
45	1.5	1.4	1.5	1.5
67½	2.5	2.4	2.5	3.5
90	4.5	4.0	3.9	6.0

Above figures are at zero grid bias

The table shows that the "B" battery current drain increases much more rapidly than the increase in voltage. For example, if the voltage doubles from 45 to 90, the current drain increases three-fold in one case and fourfold in another case. This all means that the life of the "B" battery may be materially lengthened by not using a higher voltage than is necessary to obtain the desired results.

The most popular type of receiver today has at least three tubes, operating a loud speaker. As ordinarily employed, it places a fairly heavy drain on the "B" battery.

Under light and heavy service, Eveready "B" Batteries prove up. More and more fans buy them every day because they are the most economical. According to the work they have to do, so is their life.

You get most energy for your money in Eveready "B" Batteries—they last longer.

## "the life of your radio"



The Metal Case Eveready "B" Battery No. 766. The popular 22½-volt Eveready Battery in a new, handsome, durable, waterproof

metal case. At all dealers, \$3.00.

Eveready "B" Battery No. 767. Contains 30 large size cells, as used in the popular No. 766. Voltage, 45. Made especially for sets using detector and



one or more stages of amplification. The most economical "B" Battery where 45 volts are required. At all dealers, \$5.50.



Eveready Radio Battery No. 771. The Eveready "Three," the ideal "C" Battery. Voltage, 4½—three terminals permitting the use of 1½, 3, or 4½ volts. The correct use of this battery greatly prolongs the life of the

"B" Battery. At all dealers, 70 cents.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC.  
Headquarters for Radio Battery information  
New York, N. Y.

# EVEREADY

## Radio Batteries

—they last longer

NOTE—This is No. 4 of a series of informative advertisements, printed to enable users to realize the utmost in battery economy. If you have any battery problem, write to G. C. Furness, Manager, Radio Division, National Carbon Co., Inc., 124 Thompson Avenue, Long Island City, N. Y. Ask for special booklets on "A", "B" and "C" batteries.

"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"



## When Radio called, Eveready was ready

**T**WENTY-ONE years ago, when wireless telegraphy had its first birthday, National Carbon Company's dry cell batteries were nine years old. Even then, its batteries were world famous as convenient, economical and efficient sources of electric energy.

With the introduction of popular broadcasting, radio leaped into universal service. Radio engineers used Eveready Batteries as their standard in designing tubes and receiving sets. Eveready engineers, backed by the most complete research and testing

laboratories known to the industry, worked with them to discover how the known dry cell could be improved for radio work.

The fruit of these efforts is the Eveready family of radio batteries conspicuous for vitality and endurance—the right battery by test and proof for every radio use.

Insist on Eveready Batteries—they last longer.

Informative and money-saving booklets on Radio Batteries sent free on request.

NATIONAL CARBON COMPANY INC.  
New York, N. Y.

### Headquarters for Radio Battery Information

If you have any battery problem, write to RADIO DIVISION, NATIONAL CARBON COMPANY, INC.  
124 Thompson Ave., Long Island City, N. Y.



Eveready "B", 22½ volts,  
No 766 with Six Fahnestock  
Spring Clip Connectors

Radio has moved from the laboratory and amateur's work-table out into the refined surroundings of the family living room. In keeping with this new companionship we offer this reliable, long-lived Eveready "B" Battery, in an attractive, new metal case, worthy to stand beside the rich cabinets of fine radio sets.



# EVEREADY

## Radio Batteries

*—they last longer*

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



## A PERFECT SET

For

AMATEUR

D.X. RADIO RECEPTION



While primarily building Radio Apparatus for broadcast listeners, hundreds of amateurs everywhere have learned of the wonderful efficiency of ACE Radio Receiving Sets for amateur DX Radio reception.

With their sharp and efficient tuning range over the broad band of wave lengths from below 200 meters to 600 meters, combining Armstrong Regenerative principles with careful design of parts and elimination of high frequency resistance in each unit, and absolutely free from body capacity effects, Ace Receivers in the hands of the DX "ham" will produce better results, tube for tube, than any Receiver that you can build or buy.

Almost unbelievable reports of stations copied have been received by the manufacturers from some of the best DX men in the business.

Ask your dealer to let you try out an Ace Receiver, and you will find that it is just what you have been looking for.

Recommend to some of your young friends who are just entering the game that they purchase an ACE TYPE V \$20.00 receiver—for the more advanced amateur, the three tube ACE 3B Combined Regenerative Detector—and two stage Audio Frequency Amplifier will be the best thing you ever had on your table.

All Ace Radio Sets  
Manufactured Under  
Armstrong U.S. Patent  
No. 1,113,149.

### THE PRECISION EQUIPMENT CO.

*Powel Crosley, Jr., President*

118 Vandalia Ave., Cincinnati, Ohio



# The COURT JESTER of TODAY

"No wit to flatter left of all his store,  
No fool to laugh at, which he valued  
more."

—Pope

SINCE the earliest days, laughter and gaiety have been the most sought after things in life. In ancient times stately rulers unbent, courtly knights forgot seriousness; beautiful ladies became more alluring as the clever quips and merry pranks of the court jester brought a sparkle to their eyes and drove dull care away. But they were limited to the clownish antics and slap stick comedy of the jester.

Moderns have unlimited sources of amusement. Every broadcasting station has its Jester; its humorous stories; amusing songs and clever comedies. Each night the air is filled with merriment.

With a Crosley Modey X-J radio receiver, amusement may be brought clearly and distinctly to your fireside. Sitting comfortably in an easy chair you forget dull care. The magic wand of the radio sends worry scurrying.

The very moderate prices of all Crosley instruments bring radio within the reach of all. No matter which Crosley Model you may select you can be assured of the maximum results at the lowest cost.

Let a Crosley Radio Receiver bring fun, laughter and good humor into your home.

**CROSLEY**  
Better - Cost Less  
Radio Products

See the Crosley Line  
at Good Dealers Everywhere

Write for Free Catalog. This fully describes the Crosley line of Radio receivers which range in price from the Model VI, a 2 tube set at \$30, to the graceful Console Model X-L at \$140. It also shows the complete line of Crosley parts.



## Crosley Model X-J—Price \$65

For tuning out local interference and bringing in distant stations this receiver is unexcelled. It is a 4 tube set combining one stage of tuned radio frequency amplification, detector and two stages of audio frequency amplification.

**For bringing in distant stations no set can excel it.**

Cost of necessary accessories \$40.00 and up.

**CROSLEY MANUFACTURING CO.**

Powel Crosley, Jr., President

118 Alfred Street, Cincinnati, Ohio

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



**CROSLEY** \$  
*Model X-J* **65**

The Broadcasting Station WLW  
is maintained by the

**CROSLEY MANUFACTURING COMPANY**

## MAIL THIS COUPON TODAY

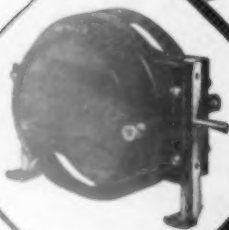
Crosley Manufacturing Co.,  
118 Alfred St., Cincinnati, O.

Gentlemen: Please mail me free of charge your complete catalog of Crosley instruments and parts together with booklet entitled "The Simplicity of Radio."

Name .....

Address .....

# REMLER VARIOMETER



**Acknowledged  
Everywhere**

**AS THE MOST EFFICIENT  
RADIO ITEM ON THE  
MARKET**

**INTERNAL PIGTAIL CONNec-  
TIONS—WAVE LENGTH  
RANGE 180-570 METERS POS-  
ITIVELY GUARANTEED**

**TYPE  
500**

**WITH  
CLOSED  
ROTOR**

**\$7.50**

**F**ROM the enthusiastic reports constantly received from all points of the country, this new type Remler Variometer has proved a winner in appearance and performance from the day it was placed on the market.

The perfect contact and quiet operation obtained by reason of the pigtail connection between stator and rotor is a big feature in itself, but the low minimum and high maximum wave length—the greatest ever obtained in a Variometer is a Remler accomplishment.

The wave length variation is exactly proportional to the reading of the dial scale. It will cover the entire range of amateur and broadcast wave lengths when used with any variocoupler. When used with a Remler-variocoupler the wave length is guaranteed to be from 180 to at least 570 meters. All meta. parts are buffed and nicked; green silk wire is used on both stator and rotor. The general appearance and quality of the bakelite molding is the best ever built into a radio item.

*If your dealer cannot supply you, send the attached coupon direct to us with certified check or postal money order. Write for complete descriptive circular.*

Remler Radio Mfg. Co.,  
182 Second St., San Francisco  
Gentlemen:—

As my dealer is unable to supply me with your new Remler Variometer I wish to place my order direct with you and am enclosing certified check or money order for \$7.50.

It is understood that if after a 10 day free trial I find that this Variometer does not conform to your statements, my money will be refunded upon return of the instrument to you in the condition it was received.

Name .....

Address .....

**Remler Radio Mfg. Co.**

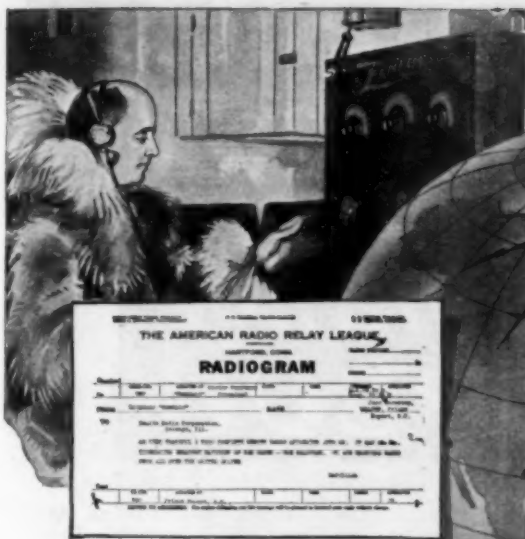
**Home Office**

**154 West Lake St., 182 Second Street  
Chicago**

**San Francisco**

**30 Church Street  
New York City**

**ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS**



THE AMERICAN RADIO RELAY LEAGUE  
RADIOGRAM

TO: \_\_\_\_\_  
FROM: \_\_\_\_\_  
SUBJECT: \_\_\_\_\_  
RE: \_\_\_\_\_

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

BY: \_\_\_\_\_

RECEIVED BY: \_\_\_\_\_

REMARKS: \_\_\_\_\_

# ZENITH

Licensed under  
Armstrong  
U. S. Patent  
No. 1,113,140

## AT THE NORTH POLE



**MODEL 4R**—The new Zenith 4R "Long-Distance" Receiver-Amplifier comprises a complete three-circuit regenerative receiver of the feed-back type. It employs the Zenith regenerative circuit in combination with an **AUDION DETECTOR** and **THREE-STAGE** audio-frequency amplifier, all in one cabinet.

The Zenith 4R may be connected directly to any loud-speaker **WITHOUT** the use of other amplification for full phonograph volume, and reception may be satisfactorily accomplished over distances of more **\$85** than 2,000 miles.....



**MODEL 3R**—The new Zenith 3R "Long-Distance" Receiver-Amplifier combines a specially designed distortionless three-stage amplifier with the super-efficient Zenith three-circuit regenerative tuner.

Fine vernier adjustments—in connection with the unique Zenith aperiodic or non-resonant "selector" primary circuit—make possible extreme selectivity.

### 2,000 to 3,000 Miles with Any Loud-Speaker

With the new Zenith 3R satisfactory reception over distances of 2,000 to 3,000 miles and over, is readily accomplished in full volume, using **ANY ORDINARY LOUD-SPEAKER**. No special skill is required. The Model 3R is compact, graceful in line, and built in a highly finished mahogany cabinet..... **\$160**

### ZENITH RADIO CORPORATION,

Dept. D 328 So. Michigan Ave., Chicago, Ill.

Gentlemen:—  
Please send me illustrated literature on Zenith Radio.

Name .....

Address .....

**I**NSIDE the Arctic Circle, nine degrees from the North Pole, a little 89-foot schooner is frozen fast in the ice of Smith Sound. Aboard this schooner a group of brave men are enduring, as best they can, the desperate cold of the Arctic—cold that often drops to 60 degrees below zero. Human atoms in a boundless field of ice!

Cold is hard to endure, but far more terrible is the Arctic solitude—unbelievably oppressive. Radio, at length, has broken this spell forever!

### Concerts from Honolulu!

Daily, by means of powerful sending and receiving apparatus, the crew of the "Bowdoin" are in communication with relatives and friends in the far-off States. Daily they listen to concerts as far away as Chicago, Dallas and Honolulu!

When the sanity, the very lives of one's ship-mates may depend upon contact with the outside world, none but the **BEST** is good enough.

### Dr. MacMillan's Choice—the Zenith

Out of all the radio sets on the market, Dr. MacMillan selected the Zenith exclusively—because of its flawless construction, its unusual selectivity, its dependability and its tremendous **REACH**.

Already his operator, on board the "Bowdoin" IN **NORTHERN GREENLAND**, has tuned in several hundred stations. You along the Atlantic who brag a little when you tune in Catalina Island—what would you say if you tuned in Hawaii **FROM THE ARCTIC CIRCLE?**

The set that Dr. MacMillan has is a standard Zenith receiving set. And you can do all that MacMillan does, and more, with either of the two new models shown at the right. Their moderate price brings them easily within your reach. Write today for full particulars.

**Zenith Radio Corporation**  
McCormick Building, Chicago





# WESTON Instant Change PLUG

To see this plug is to admire it. To feel its lightness and ease of grip is to want it. But to change from one set of phone cables to another with it—means that you *must own it*. Interchangeable in 2 seconds. Merely press triggers to pull cables out. Shove cables in to connect. Always perfect contact. No tools. No broken fingernails, inconvenience or lost time. Operators everywhere admit its infinite superiority. Ask your dealer to let you see it or get it for you. Full information upon request.

Write today for particulars.

WESTON ELECTRICAL INSTRUMENT CO., 158 Weston Ave., Newark, N. J.  
Branch Offices in All Principal Cities

Electrical  
Indicating  
Instrument  
Authorities  
Since 1888

# WESTON

STANDARD - The World Over



## AT YOUR DEALER'S COUNTER

Buy a good Head Set.  
Good Head Sets must have Powerful Magnets.  
Powerful magnets ensure sensitivity, great volume of sound and true tonal quality.  
The power of Head Set magnets is easily tested at your dealer's counter. Unscrew the cap on the ear piece. Place the thin circular diaphragm on the counter. Hold the ear piece above it and see how far the magnet will pick up the diaphragm. The farther the pick up, the more powerful the magnet, and the better the Head Set.  
A Stromberg-Carlson Head Set will pick up its diaphragm at least one-fourth of an inch. Will yours?



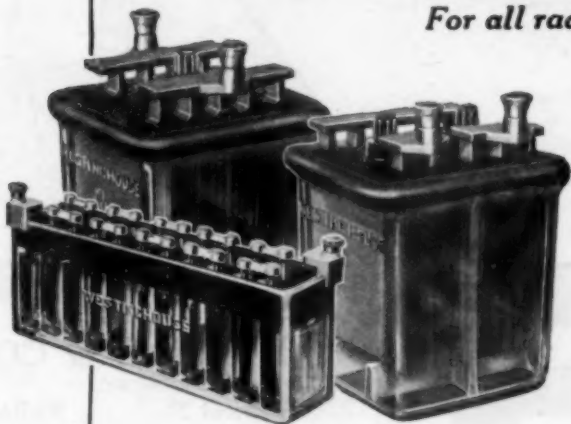
**Stromberg-Carlson**



# WESTINGHOUSE

## CRYSTAL CASE "A," "B" and "C" BATTERIES

*For all radio requirements*

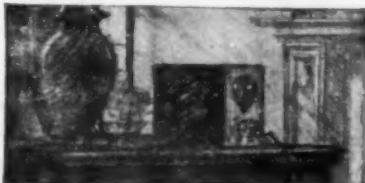


### *Better Batteries— Better Radio Reception*

Every radio fan knows the importance of sustained battery voltage in a radio receiving set. A sudden drop in filament voltage, for example, is exasperating. Right here the name Westinghouse becomes significant. As in automobile batteries, Westinghouse Radio Batteries are the finest Westinghouse can build. The new **CRYSTAL CASE** types are especially efficient. Even-powered, slow-discharging, you'll quickly note their superiority for fine tuning, signal holding and sound volume. So economical too! They last indefinitely and are easily recharged at a few cents' cost.

**CRYSTAL CASE "A" Batteries**—One-piece glass case with solid glass cell partitions and plate rests. Visible interior. 2, 4 and 6-volt sizes. **CRYSTAL CASE "B" Batteries**—The 22-MG-2 (22 volts) is a wonder for steady, noiseless, full-powered service. Rechargeable, of course. Larger types, too. Also "C" batteries in 6-volt units.

**WESTINGHOUSE UNION BATTERY CO.**  
Swissvale, Pa.

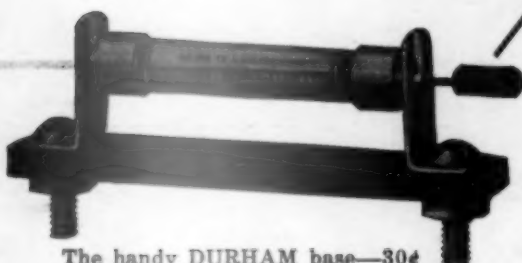


## Get that extra-DX a bit more often

Events of great note are those rare occasions when your set far exceeds its usual range. You'd like to keep permanently some of that Extra-DX. And you can—by patient tuning—and accurately adjusting the detector grid leak. Here's where little Omega Durham helps with his reliable plunger control. Try him out—get more of that Extra-DX.

### New folder—Free

Little Omega Durham tells how he works—and why he's sure he can help you. Get your copy from dealer.



The handy DURHAM base—30¢

Omega Durham  
—now an author



Buy  
from  
your dealer

### Durham Variables—75c

No. 100 —1,000 ohms to 0.1 megohms  
No. 101 —0.1 megohms to 5 megohms  
No. 201A—2 megohms to 10 megohms

Manufactured by

**DURHAM & CO.**

Station WCAU

1936 Market St. Philadelphia

Dealers:—DX receiving is only one of Little Omega Durham's accomplishments. His many friends bring in lots of DX business!

## The Tube's The Thing!

New Improved

## MYERS TUBES

### Guarantee Perfect Reception

Hear without noise or tube hiss. Myers Tubes give much greater amplification. They add 50% to the efficiency of your set because they reduce internal interference.

TWO TYPES: Myers Dry Battery Tube 2½ Volts—¼ Ampere. Myers Universal operates on either 3 Dry Cells or storage batteries. \$5.00 each. Ready mounting. No extra equipment needed.

Insist on the New Improved Myers Tubes with the Silver Coating. Others not guaranteed.



(½ size)

**\$5**  
EACH

At your Dealer—otherwise send purchase price and you will be supplied Postpaid.

Sole Manufacturers

**F. B. Myers Co. Ltd.**  
*Radio Vacuum Tubes*

240 Craig Street, West  
MONTREAL, CANADA

"Built by the  
Master Builder"



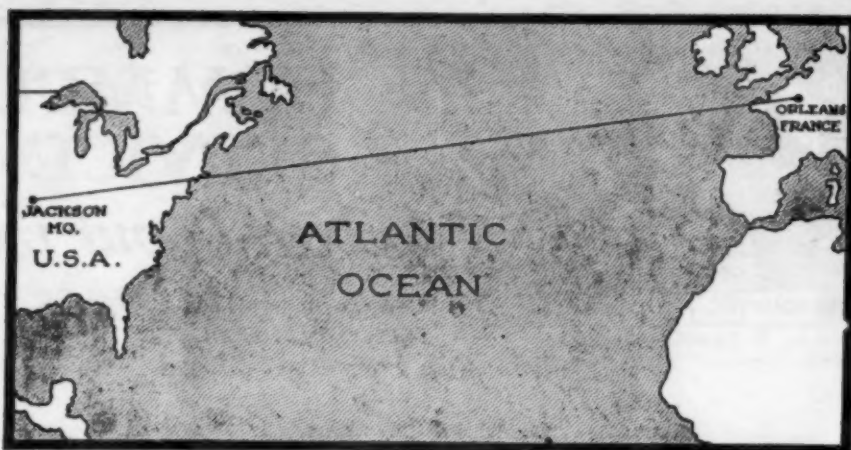
The perfect radio switch—correctly designed and skillfully constructed. Installed on any panel in five minutes to add hours of convenience, and protect both tubes and batteries. At dealers everywhere—insist on the genuine—in the orange and blue box. If your dealer has not been stocked send 60c plus 10c for packing and you will be supplied direct.

THE CUTLER-HAMMER MFG. CO.

Member Radio Section

Associated Manufacturers of Electrical Supplies  
Milwaukee, Wisconsin

## RADIO SWITCH



## MISSOURI reaches FRANCE and thanks ACME

MR. ALVIN R. UELEKE (Radio 9DWK) who was officially mentioned as having reached Orleans, France during the trans-Atlantic tests conducted by the American Radio Relay League last December wrote on March 26th as follows:

"I am pleased to inform you that due to the excellent performance of your products, I was able to have signals from my station heard in Orleans, France.

"In my equipment, I am using one of your 600 watt power transformers, unmounted type, to supply plate and filament current; the plate supply, 1000 volts, being rectified by a 48 jar chemical rectifier, and filtered by 8 Mfds. of filter condenser and two of

your 500 MA single  $1\frac{1}{2}$  henry choke coils. Using Hartley oscillating circuit the antenna current was about 5 Thermo Couple Amperes."

Amateurs desiring to enter the next series of tests or those who have entered previous ones without success, are welcome to write to this company, explaining their intentions or difficulties in detail. Our engineering department will be glad to aid them in any way possible. The coupon below is for the convenience of those who desire to familiarize themselves with the newest Acme Transmitting Apparatus. The Acme Apparatus Company, Dept. 34, Cambridge, Mass., Branches, New York, Cleveland, Chicago, Kansas City, San Francisco.

# ACME

*for*  
**transmission**

Acme Apparatus Company  
Dept. 34, Cambridge, Mass.

GENTLEMEN:—Kindly send me your latest catalog of:

- ☐ Transmitting Apparatus
- ☐ Receiving Apparatus
- ☐ Booklet on Amplification without distortion (Enclose 10¢)

Name .....

Street .....

City .....

State .....



## Use HOMMEL SERVICE to build your radio business

AMATEURS—Tell us what you are interested in—send us the name of your dealer and we will see that you are supplied promptly.

Complete stocks of strictly high grade nationally advertised radio apparatus are constantly carried by this company to enable you to build your radio business on the right foundation. Your success is dependent largely on the products you sell, and your ability to serve your customers promptly.

Aligning yourself with the Hommel organization makes it possible for you to always have access to ample stocks of the leading lines of radio equipment without the necessity of tying up your working capital.

Let us show you how you can advantageously use Hommel Service—  
Write for Hommel's Encyclopedia of Radio Apparatus 2236-T.

# LUDWIG HOMMEL & CO

530-534 FERNANDO ST.

PITTSBURGH, PENNA



## U. S. TOOL CONDENSERS

Oxidizing of ordinary plates and spacers, creates a high resistance to the weak radio frequency currents. U. S. Tool Condensers are protected from this deterioration by a special counter-chemical treatment. End plates of Laminated Condensite-Cel-eron. Reasons for the persistent efficiency of U. S. Tool Condensers. Unconditionally guaranteed.—Write for booklet.

**U. S. TOOL  
COMPANY INC.**

**112 Mechanic St.  
Newark, N. J.**



The Champ—VARIOMETER No. 53

Approved as a Record Breaker

Approved—because it makes 600 Meters.

Approved—because perfectly constructed.

Approved—because it has a genuine mahogany stator and a kiln dried rotor.

Approved—because of Fahnestock spring clip connections and non-conductive adhesive.

Approved—because you'll know why when you

**GET ONE FOR \$3.50**

**20 Diagrams FREE with Each**

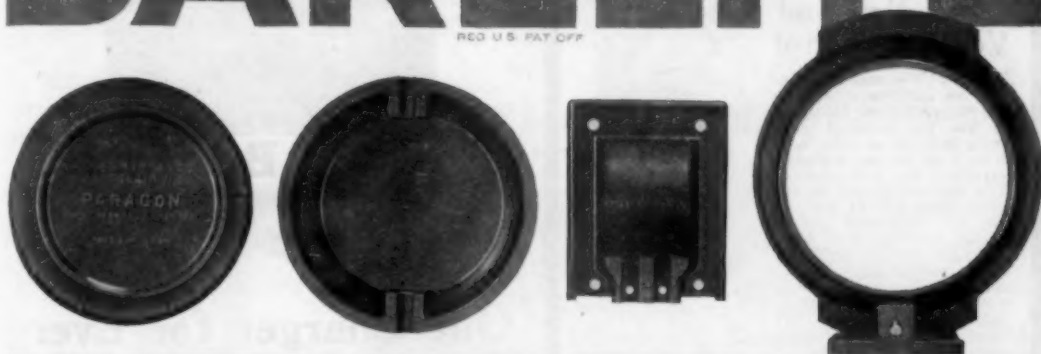
For sale at your dealer's—otherwise send the \$3.50 directly to the manufacturer and you will be supplied postpaid.

**G. H. FISCHER & CO.**  
123 Liberty St. New York City



# BAKELITE

REG. U.S. PAT. OFF.



## Paragon and Bakelite

The pleasure and satisfaction that the Paragon Receiver brings to the family circle is appreciably increased through the use of Bakelite.

Bakelite possesses a combination of properties not found in other materials, which makes it peculiarly suitable for this service. Its excellent electric properties provide complete insulation that remains unimpaired under all atmospheric conditions. Because of its high temperature resistance and non-absorbent properties, Bakelite performs equally well in all climates.

Its great mechanical strength, permanent beauty of finish and color enhances the value of any Radio Equipment in which it is used.

The Adams-Morgan Company chose Bakelite because of these desirable qualities and, for the same reason, leading Radio Manufacturers have adopted Bakelite as standard insulation for the manufacture of parts and complete units.

Send us your name and address and we will mail you a copy of our Radio Booklet C.

### BAKELITE CORPORATION

247 Park Avenue, New York, N. Y.  
Chicago Office: 636 West 22nd Street

#### BAKELITE Condensite REDMANOL

are the registered  
Trade Marks for the  
Phenol Resin Products  
manufactured under  
patents owned by  
**BAKELITE  
CORPORATION**



THE MATERIAL OF A THOUSAND USES

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

# TINY-TURN

## A New and Superior Vernier Control

TINY TURN makes possible an exactness in tuning never before attained. It has a 30 to 1 gear ratio instead of only 4 or 5 to 1 as in the ordinary vernier. No lost motion! The vernier turns in the same direction as dial. It can be instantly disengaged, leaving dial free. **INSTALLED ON ANY SET IN 3 MINUTES.** Handsome nickel and black finish. Packed in individual containers. We furnish counter display demonstrating boards.

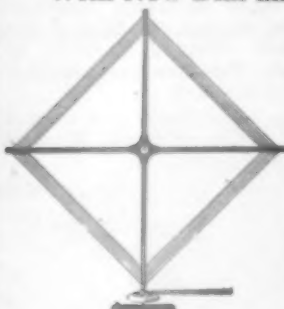


*Pats. Pend.  
Side View showing friction drive against dial.*

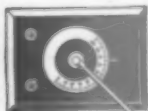
Price 75 cents

# DUO-SPIRAL

## The Leading Loop Aerial With New Dial and Handle



*Pats. Pend.*



*Top View of Base showing dial.*

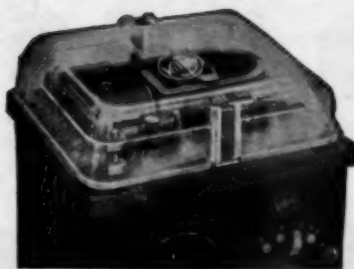
loop completely replaces roof antenna and ground practically eliminates static. It is right in every detail.

24-inch size...\$8.50. 12-inch size...\$7.50  
(These prices include new dial and handle)

The above products (folded on request) are sold through dealers and jobbers. If your dealer cannot supply you, write us direct.

# RADIO UNITS INC

Suite 508, Webster Building,  
Chicago, Illinois



## For All Batteries

## One Charger for Every

# RADIO BATTERY

Longer distance and clear signals are the pleasing results which you can be sure of when both the A and B batteries of your radio set are storage batteries. No other source of power for radio equals the storage battery.

The Valley Type ABC Battery Charger is so simple and so easily operated that it makes storage batteries the most convenient and inexpensive source of power for radio. Enjoy radio at its best. Use storage batteries and charge them with the Valley Type ABC Battery Charger.

The Valley Type ABC Battery Charger is made to charge:

2-volt Peanut Tube Batteries

6-volt A Batteries

6 and 12-volt Automobile Batteries

1 to 4 B Batteries

Bakelite panel, glass top. Harmonizes with any receiving set. And as simple as ABC to operate. Plugs in on the light socket like a lamp and connects to battery by means of regular battery clamps.

At all good radio shops.

VALLEY ELECTRIC CO.,

3157 S. Kingshighway, St. Louis, Mo.

## Valley Battery Charger

# RADIO FREQUENCY AMPLIFICATION

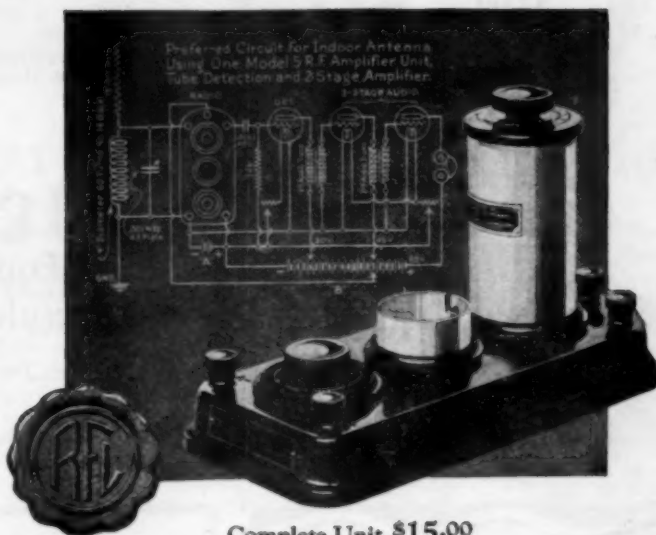
WITH

## Ballantine Variotransformers

(Patents Pending)



Model 5 \$9.60



Complete Unit \$15.00

### "TURN THE KNOB"

1. Continuous variation in wave length.
2. Self-contained and shielded.
3. Control of regeneration and tuning by single knob: *no potentiometer.*
4. Fits your set — either base or panel mounting.
5. Improved tone quality.

*"Radio Frequency Amplification with the Ballantine Variotransformers" — a 25-page booklet — mailed free on request.*

## BOONTON RUBBER MFG. CO.

*Pioneers in Bakelite Moulding*

124 FANNY ROAD

BOONTON, NEW JERSEY

## The unexcelled performance of Federal Standard Radio Products



Price  
**\$7.00**

2200 OHMS

is the audible evidence of the fine material and engineering skill which go into every Federal part. And the Federal guarantee is the insurance of satisfaction to every Federal purchaser.

Federal Head Sets are one of the more than 130 radio products which Federal manufactures and guarantees. Your receiving set is no better than its weakest part. Insist on Federal.



# Federal

## Radio Equipment

### Federal Telephone and Telegraph Company

FACTORY: Buffalo, N. Y.

Boston New York  
Bridgeburg, Canada

Philadelphia

Chicago

San Francisco

Pittsburgh  
London, England

## The Satisfactory Charger For Ten Years Past

The F-F, the first successful mechanical charger, is now the most popular. F-F features are distinctive, its construction is simple, and the absence of breakable parts which are expensive to replace, is almost sufficient reason for you to own the F-F; but the satisfaction you will buy with the low purchase price of the F-F is further reason why you should insist on the F-F. Buy from your dealer. There's a type for every need. If he cannot supply you, write for literature or enclose remittance covering express or postal charges on 9 lbs.

IT'S FREE—Write for Bulletin No. 31

# \$15.00

F. O. B. Cleveland

Type 6 charges 6 volt Storage Battery from any 110 Volt 60 Cycle lamp socket at average rate of 6 amperes, or over if battery needs it.

The France Mfg. Co.  
10431 Berea Road  
Cleveland, Ohio



Oldest Manufacturer of the First Successful Mechanical Charger.

## The New Freshman CAPACITY FINDER

permits you to actually measure the condenser values necessary in your hook-up



31  
Capacities for  
the Cost of  
5

## FIND OUT

just what value of a condenser will give your hook-up the best results in the grid circuits, across the phones, in the Antenna Circuit, across transformers, battery circuits, etc.

Price \$2.25

including the 5 special Freshman Condensers.

At your dealers, otherwise send purchase price and you will be supplied postpaid. Ask your dealer or write for complete instructions free.

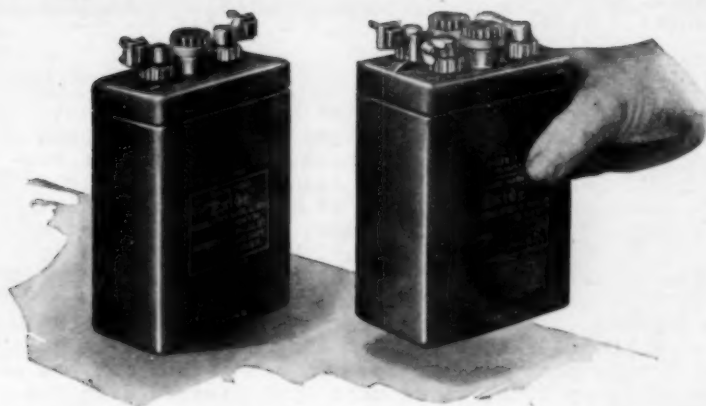
## Chas. Freshman Co. Inc.

Radio Condenser Products

108 Seventh Avenue

New York





## What you have been waiting for

**H**ERE are two rugged little storage batteries designed particularly for low-voltage tubes.

Although they weigh only 5 and 6 pounds, they are of true Exide quality. Highly efficient and with ample power for long-distance receiving, these batteries will give you a type of service that you would find it hard to duplicate.

These sturdy little batteries are neat and compact. They were specially designed for WD-11 and UV-199 vacuum tubes, but can be used with any low-voltage tube. The two-volt Exide A Battery consists of a single cell. It will heat the filament of a WD-11 or other quarter-ampere tube for approximately 96 hours. The four-volt A Battery, having two cells, will light the filament of a UV-199 tube for 200 hours.



### For six-volt tubes

Like all Exide Storage Batteries, the Exide A Battery for six-volt tubes is dependable and long-lasting. It is made in four sizes, of 25, 50, 100 and 150 ampere hour capacities.

adjustment that make radio receiving an unalloyed pleasure.

The Exide A Battery for six-volt tubes has extra-heavy plates, assuring constant potential and uniform current over a long period of discharge. Like all Exide Batteries, it embodies the finest materials available.

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On sea and on land the Exide plays an important role in the industrial life of the nation. In marine wireless, Exide Batteries provide an indispensable store of emergency current. A majority of all government and commercial wireless plants are equipped with Exides.

Exide Radio Batteries are sold by radio dealers and Exide Service Stations everywhere. Ask your dealer for booklets describing in detail the complete line of Exide Radio Batteries. Or write direct to us.



### Exide B Batteries

give noiseless, full-powered service over a long period of discharge. Designed throughout to prevent electrical leakage. Capacity, 3 ampere hours.

# Exide

## RADIO BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA

*Oldest and largest manufacturers in the world of storage batteries for every purpose*

Service Stations Everywhere

Branches in Seventeen Cities

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

79

Dr. Wm.D. Reynolds,  
Denver, Colo.

Hyattville, Wyo.  
May 30. 23.

Dear Dr:

As to results obtained with the little Electric Specialty Dynamotor, I am pleased to say I have been getting wonderful results with it, but instead of running off 6 volt battery, have been using an 8 Volt, which gives me a high voltage of .600 Volts and, what everybody says, a Beautiful Tone, every card I get mentions that a fine note I have; I have talked Fone (using loop modulation) with 5SK at Fort Worth Texas, after daylight in the morning, Falconi at 5ZA Roswell New Mex. says my fone so QSA he can hear it 10 feet from Fones, and work him with CW way after sun rise, which is going some; I work most all the Boys in Denver and they're all crazy about my tone. I am more than pleased with the Dynamotor, and any time I can be of service to you regarding its action just let me know.

Yours truly,

*L.G. Vandlyke*

TRADE "ESCO" MARK

*Quality always Supreme*

ELECTRIC SPECIALTY COMPANY  
STAMFORD, CONN, U. S. A.



TRADE MARK

**AUDIOPHONE**

REG. U. S. PAT. OFFICE

**LOUD SPEAKER**

A REAL REPRODUCER  
OF THE ORIGINAL BROADCASTING

It is easy to listen to the reproductions made by the Audiophone because they are so perfect. The speech, the songs, and instrumental music are not blurred or disguised by mechanical distortions. You will get all the fine shadings and every inflection. In fact, the very personality of the artist seems to be present as you listen.

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**THE BRISTOL COMPANY**  
WATERBURY, CONN.



Get this new  
**MURDOCK  
PLUG-JACK**

and you can connect  
four pairs of head-  
phones to your  
Radio Set at  
one time—

only **\$1-**

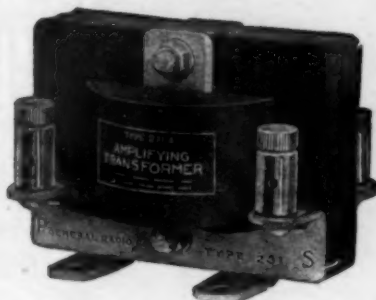
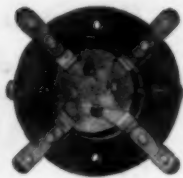
For 19 years  
**MURDOCK** Radio Apparatus  
has satisfied users the world over.

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If your dealer cannot supply you send  
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### AMPLIFICATION

by General Radio amplifying units saves time, money and patience.

They give satisfaction, distortionless volume and a life-time service.

Guaranteed

#### Types

#### Prices

300C for UV 199 tube \$7.75

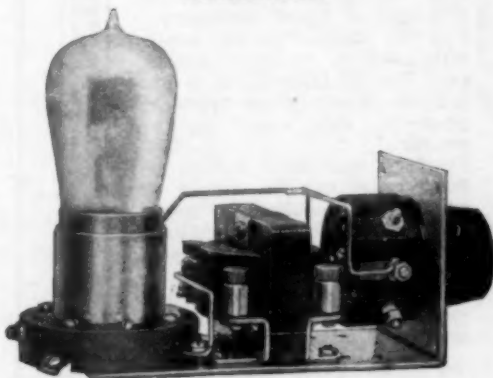
300D for UV 201 tube 8.25

Write for free descriptive  
Bulletin 916Q

Plus a  
**QUALITY**  
RHFOSAT



Makes a  
**QUALITY**  
AMPLIFIER



And Made By

## GENERAL RADIO CO.

Manufacturers of  
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Massachusetts Avenue and Windsor Sts.  
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## ANYONE Can Operate the *WL* **Radiodyne**

*"The Voice of the Nation"*

You don't have to be an expert to install and operate the **RADIODYNE** effectively. It is operated by simply grounding to a water pipe or radiator and throwing a few feet of wire on the floor. No outside antenna or loops necessary. For use in apartments, boats, automobiles, railroad trains, etc., the **RADIODYNE** is enjoyable where other types of receiving sets would not be practical.

Stations within a radius of 2000 miles can be picked up on the loud speaker any wavelength from 200 to 700 meters. The **RADIODYNE** is so sensitive that it picks up Radio telephone speech and music when other types of equipment fail.

TO THE A.R.R.L.

We appreciate your efforts in boosting W.C. sets and are always pleased to furnish full information about them to members who have not yet had the opportunity to operate a Radiodyne. We want every member to know the merits of this efficient outfit. If you are interested we will gladly send you a complete description of the Radiodyne together with information as to where you can see one in operation.

*Just drop us a line and we will see that your inquiry gets prompt attention*

Western Coil & Electrical Company  
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## ELECTRAD PRODUCTS

**\$2**

Socket 50c



Write for  
**FREE** Cock-  
aday Diode  
Reflex Cir-  
cuit.

### The NEW DIODE

Discard crystals! Use the Electrad Diode in all circuits. Overcomes former difficulties with reflex work. Gives greater volume, greater selectivity and steadies the circuit. Eliminates tedious adjustments for change of wave lengths. A perfect detector tube. Real results. Absolutely guaranteed.

**Radio's Greatest Invention**



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Double your receiving distance. Give the precision value of grid leak resistance your detector tube requires. Variohm does the work of a thousand ordinary grid leaks. Resistance variations secured are infinitely close and gradual, not by steps and jumps. Range  $\frac{1}{4}$  to 10 megohms. Increases volume. Eliminates circuit noises. Enables you to get distant stations clear and distinct. Absolutely guaranteed.

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Fits right under closed window. Can be bent into any shape to fit ledges. Covered with fire-proof insulating material which prevents grounding of circuits on wet window sills. Takes the place of ungainly porcelain tubes and holes in the window sash. Always presents a neat appearance.



**40c**

All products at your dealers, otherwise send purchase price and you will be supplied postpaid.

**ELECTRAD, Inc.**  
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# THORDARSON KENNEDY

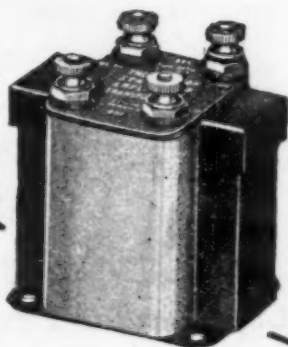
*The Royalty*



*of Radio*

The Colin B. Kennedy Co., internationally renowned for their **QUALITY RECEIVING SETS**, are equipping all their sets with Thordarson super-transformers.

**BE**



**CONVINCED**



The Zenith Radio Corporation, manufacturers of **LONG DISTANCE RADIO RECEIVERS**, famous for the Berengaria record and their accomplishments on the S. S. Bowdoin at the North Pole, also have adopted Thordarson super-transformers as standard equipment.

## SUPER TRANSFORMER

## YOUR "B" BATTERY!

Test it with a

# \$2.50

\$2.50

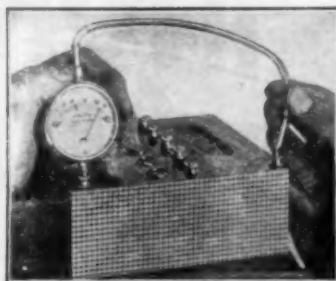
# HOYT

Pocket Meter

Range: 0-50 volts

In addition HOYT builds a complete line of meters for receiving work:

PEEP-HOLE—specially designed to fit in the peep-hole on the panel—will protect your tubes—no guess work. Built as a volt-meter or ammeter.



RADIO ROTARY—a general testing volt-ammeter of exclusive design.

SWITCHBOARD METERS—A complete line ranging in diameter from 2 1/4" to 8".

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Sales Department For

## HOYT ELECTRICAL INSTRUMENTS

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Please send information on HOYT  
RADIO METERS.  
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New Term Begins  
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We give separate  
elementary (2  
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The radio profession pays well. Amateur experimenters are in great demand. Your present knowledge will shorten your course with us. Commercialize your amateur experience. Special amateur stations with wave power privileges demand extra first grade amateur licenses which require 20 words code speed and definite knowledge of tube circuits. There is a great shortage of commercial operators. Wages are rising; some companies are paying as high as \$140.00 a month. Sail on American ships to all parts of the world. Positions guaranteed. Through our favorable connections with operating companies as well as our continued success in training operators we are now supplying about 90% of the ship operators sailing from Boston.

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Super-Vernier Rheostat

**\$3.00** Two windings in parallel—one 6 ohms—other 40 ohms. Absolutely noiseless. Infinite control. Handles any tube. Cap. 3 amp. Bakelite molded. Silver etched dial. Fully guaranteed. Ask your dealer. Get our Free Bulletin No. 92.

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One dry cell is all that is required to operate this instrument.

Made by the best Telegraph Instrument Makers in the World.

Other types carried in stock.

Send stamp for Telegraph Manual No. 43Q.

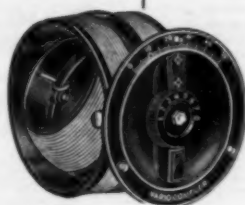
Instrument only.....\$5.00

With dry battery..... 5.50

Special Price to Dealers

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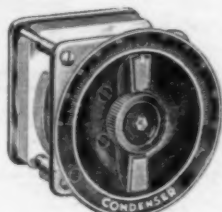
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## *Build your own Radio Set*

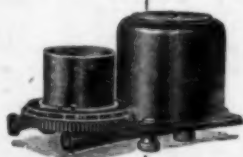
—and save half the labor customarily involved.

The panels are completely drilled, and the parts are simply fastened with screws and nuts.

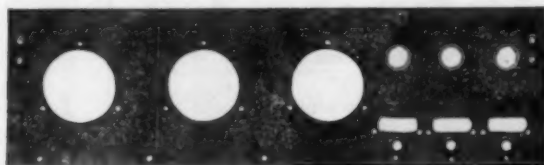
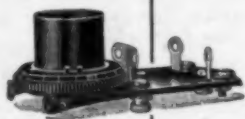


Any circuit desired may be employed. We have eight different types of panels.

The crystal black panel finish, together with the concave dials, lend a pleasing effect—the absence of knobs giving a clean, flush appearance.



You can build, or buy, a cabinet to suit your individual taste.



*Illustrated catalog upon request*



**EISEMANN MAGNETO CORPORATION**

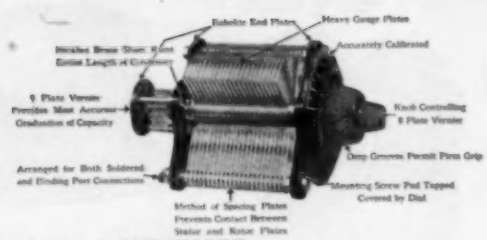
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## THE NEW CHELTEN RADIOSCOPE CONDENSER

Produces results not possible with ordinary type condensers. The 9 plate **VERNIER** feature is far more selective than the single or any multiplication of larger plates. The **RADIOSCOPE** is made in 45 and 23 plate type. It is extremely accurate and tunes sharply.



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Carefully designed for high oscillating **RADIO FREQUENCY** Circuits. We have developed a Special High Resistance Insulation which is used between the rotor and stator plates to prevent leakage of Radio Frequency Currents. This Special Insulation shows lower losses than any of the Phenol Insulating materials now on the market. Made in 45 and 23 plate types with and without Vernier.

### CHELTEN MICROFARAD JR. LOW CAPACITY CONDENSER

A special Neutralizing Condenser of extremely low capacity having only 9 plates. Adjustments are made by a turn of the knob. No body capacity when making adjustments. The most satisfactory Neutralizing Condenser made. Price \$1.75.



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Ideal for use with any Variable Condenser as a Vernier. Has 13 plates which permits of finer graduation of Capacity than is possible with a single plate Vernier. Can be used to advantage in many circuits. Price is only \$1.50.



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**THE CHELTEN ELECTRIC COMPANY**  
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## FROST-RADIO

*Ask Your Neighbor*

NEW PLUG



140  
No.

2



60c

The biggest value in a high grade 2-Fone Plug on the market. Takes two pair of **FROST-FONES**. Holds cord tips tight—never lets go. Secure several today at your dealers.

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And here's a splendid way to bring more happiness to yourself—or your friend.

For only three dollars we will send, postpaid, to you or anyone you may name, **TWENTY-FIVE** copies of **QST**—brim full of interesting, instructive and helpful information for the radio man. They comprise the following:

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- June—1919
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gives you the melody  
of concert and opera*

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**T**HE secret of the marvelous results obtained with Magnavox Reproducers does not lie in any one feature (such as the shape or material of the horn) but in the correct working out, in all features, of correct scientific principles.

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R2 with 18-inch curvex horn . . . \$60.00

R3 with 14-inch curvex horn . . . \$35.00

M1 with 14-inch curvex horn.  
Requires no battery for the  
field . . . . . \$35.00

**Magnavox Combination Sets**

A1 R consisting of electro-dynamic Reproducer with 14-

in. curvex horn and 1 stage  
of amplification . . . \$59.00

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Magnavox Products are for sale at Registered Magnavox Dealers everywhere. Write for new 32-page Magnavox Radio Catalogue.

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New York Office: 370 Seventh Avenue

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1R

*For every  
Receiving Set  
there is a  
MAGNAVOX*

## To Our Readers Who Are Not A.R.R.L. Members

Wouldn't you like to become a member of the American Radio Relay League? We need you in this big organization of radio amateurs, the only national amateur association that does things. From your reading of *QST* you have gained a knowledge of the nature of the League and what it does, and you have read of its purposes as set forth on page 6 of every issue. We would like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio, and incidentally you will have *QST* delivered at your door each month. A convenient application form is printed below—clip it out and mail it today.

1923

American Radio Relay League,  
Hartford, Conn.

Being genuinely interested in Amateur Radio, I hereby apply for membership in the American Radio Relay League, and enclose \$2.00 in payment for one year's dues. This entitles me to receive *QST* for the same period. Please begin my subscription with the \_\_\_\_\_ issue. Mail my Certificate of Membership and send *QST* to the following address.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Station call, if any \_\_\_\_\_

Grade operator's license, if any \_\_\_\_\_

Radio Clubs of which a member \_\_\_\_\_

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may write to him too about the League? \_\_\_\_\_

Thanks.

### FANSTEEL Balkite PATENTS APPLIED FOR Battery Charger

A new battery charger for Radio "A" batteries, entirely noiseless, and indestructible. Has no moving parts, requires no attention, and cannot get out of order. Can be used while the radio set is in operation. A simple, positive, economical battery charger for home use. Write for folder giving full description.

Dept. Q4 - Fansteel Products Co., Inc.  
North Chicago, Illinois

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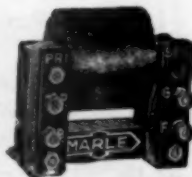
Audio and Radio  
Frequency  
Give Best Results.

Superior Quality  
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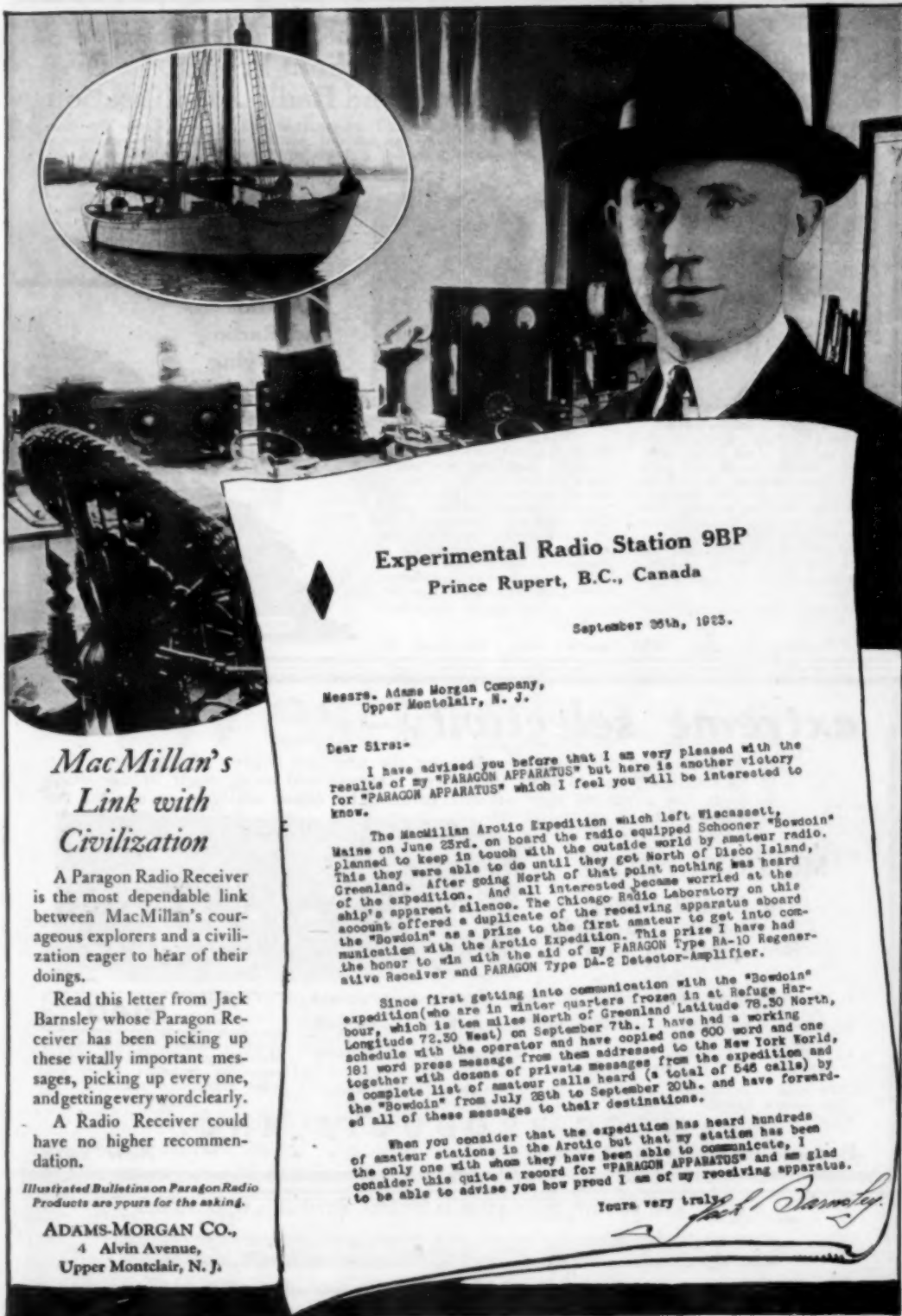
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by the Best Dealers.

Manufactured by  
Marle Engineering  
Co.

Orange N. J.



TYPE A4  
RATIO 3 1/4 to 1  
Price \$3.75



## Experimental Radio Station 9BP

Prince Rupert, B.C., Canada

September 30th, 1923.

Messrs. Adams Morgan Company,  
Upper Montclair, N. J.

Dear Sirs:-

I have advised you before that I am very pleased with the results of my "PARAGON APPARATUS" but here is another victory for "PARAGON APPARATUS" which I feel you will be interested to know.

The MacMillan Arctic Expedition which left Wiscasset, Maine on June 23rd. on board the radio equipped Schooner "Bowdoin" planned to keep in touch with the outside world by amateur radio. This they were able to do until they got North of Disco Island, Greenland. After going North of that point nothing was heard of the expedition. And all interested became worried at the ship's apparent silence. The Chicago Radio Laboratory on this account offered a duplicate of the receiving apparatus aboard the "Bowdoin" as a prize to the first amateur to get into communication with the Arctic Expedition. This prize I have had the honor to win with the aid of my PARAGON Type RA-10 Regenerative Receiver and PARAGON Type DA-2 Detector-Amplifier.

Since first getting into communication with the "Bowdoin" expedition (who are in winter quarters frozen in at Refuge Harbor, which is ten miles North of Greenland Latitude 78.30 North, Longitude 72.30 West) on September 7th. I have had a working schedule with the operator and have copied one 500 word and one 181 word press message from them addressed to the New York World, together with dozens of private messages from the expedition and a complete list of amateur calls heard (a total of 546 calls) by the "Bowdoin" from July 28th to September 30th. and have forwarded all of these messages to their destinations.

When you consider that the expedition has heard hundreds of amateur stations in the Arctic but that my station has been the only one with whom they have been able to communicate, I consider this quite a record for "PARAGON APPARATUS" and am glad to be able to advise you how proud I am of my receiving apparatus.

Yours very truly,

*Jack Barnsley*

## MacMillan's Link with Civilization

A Paragon Radio Receiver is the most dependable link between MacMillan's courageous explorers and a civilization eager to hear of their doings.

Read this letter from Jack Barnsley whose Paragon Receiver has been picking up these vitally important messages, picking up every one, and getting every word clearly.

A Radio Receiver could have no higher recommendation.

*Illustrated Bulletins on Paragon Radio Products are yours for the asking.*

ADAMS-MORGAN CO.,  
4 Alvin Avenue,  
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POCKET METERS

RECTIFIERS

FILAMENT METERS

**\$4.00**  
List Price

**Sterling**

## The Best Radio Set Available Is Weak Without Proper Audio and Radio Amplification

No matter how well constructed and assembled the set that you are using, you are not getting volume and range unless you have selected a high grade set of transformers for both radio and audio amplification. With Sterling Transformers you are assured of louder signal amplification with the best tone qualities and wide range of reception.



### Audio and Radio Amplifying Transformers

#### Audio Transformers

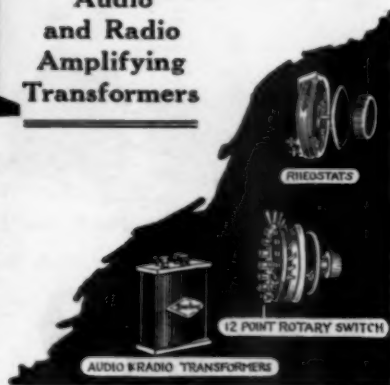
Have a closed magnetic circuit of the shell type, carefully proportioned to give best performance. A uniform amplification results throughout the entire audible frequency range. Because the entire core and winding are enclosed in an iron case the effect of stray fields is eliminated. Ratios of 4 to 1 and 6 to 1.

Both these transformers are midgets (1½" by 2" by 2½" high) but mighty powerful in effect.

#### Radio Transformers

These transformers are of the resonant type and are inherently limited to the range of wave lengths over which they will operate satisfactorily. They respond to a range of 200 up to 600 meters and give sharp tuning and high selectivity of resonance when used with a .0005 variable condenser across the secondary winding.

The Sterling Mfg. Co., 2855 Prospect Ave., Cleveland, O.



## extreme selectivity—

A single tuning adjustment—assuring the greatest degree of program selectivity enabling one to tune in desired stations and enjoy their broadcasting without the slightest sign of interference by other stations, is one of the features of

### MELCO-SUPREME

The Tuned Radio  
Frequency Amplifying  
Receiver that also



1. Operates with merely a 10 FT. WIRE—not even a ground necessary.
2. Offers exceptional CLARITY without the slightest loss of tone quality.
3. Affords real LONG DISTANCE by covering all Broadcasting ranges from 180 to 610 Meters.

We also manufacture a complete line of standard parts under the Amsco Brand. Write for our complete descriptive literature.

**AMSCO PRODUCTS, INC.**

Broome & Lafayette Streets,

Dept. Q

New York

PRICE  
ONLY **\$140**

Complete knock-down parts for Melco-Supreme including drilled engraved Bakelite panel and solid mahogany cabinet.

Price \$90

A LONG AND SKINNY INSULATOR 18 INCHES BETWEEN WIRE HOLES



Highly vitrified high tension white glazed porcelain, strength 1500 lbs.

In Lots of Six or More

**ONE DOLLAR EACH**

Express C.O.D.

**9DNH SURE FIRE RADIO LABORATORY**

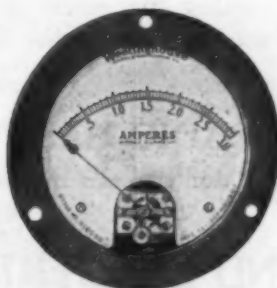
**MACOMB, ILL.**



To operate Radio Receiving or Transmission Apparatus successfully, requires the use of accurate electrical measuring instruments.



Radio Frequency Ammeter  
2-in. Dials, 2-in. Scales



Direct-Current Ammeter,  
3-in. Dials, 2½-in. Scales.  
For Radio Application.



Direct-Current Voltmeter,  
2-in. Dials, 2-in. Scales.  
For Radio Application.

# Westinghouse Radio Instruments

are small, yet accurate, sturdy and reliable. They are exact miniature replica of the larger high-grade Westinghouse instruments.

Direct-current Ammeters and Voltmeters should be used to regulate the current passing through the filament circuit of the detector or amplifier tubes, used in receiving or transmission sets.

Radio Frequency Ammeters should be used in connection with the transmitter apparatus. The effectiveness and character of transmission depends upon the current flowing through the antenna circuit.

Folder 4471-B gives full particulars

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# ARE YOU A 1923 MAN?

IF YOU ARE—GET OUT OF THE RUT.

Radio has improved with leaps and bounds since last year—to be a 1923 man is to be satisfied with last year's results—Broadcasting and CW will accomplish wonderful results this Fall and Winter and for you to share in these coming successes—both receiving and transmitting—you need a good set, made from the latest and most improved parts.

**ROSE RADIO HAS IT !!**

(and I don't mean maybe)

**ROSE RADIO AND ELECTRICAL SUPPLIES**

129 CAMP STREET,

NEW ORLEANS, LA.



How Many  
Amperes  
Are You  
Radiating?

A Roller-Smith type TAW Thermal Ammeter will tell you accurately and it will *continue* doing so. These little 3½" instruments have demonstrated their reliability in the Government service. You can't make a mistake when you use them. Bulletin No. AG-10 is yours for the asking. Send for it. This Bulletin also describes a most complete line of ammeters and voltmeters for *all* radio work.

**ROLLER-SMITH COMPANY**  
16 PARK PLACE, NEW YORK

Offices in principal cities in U.S. and Canada



**ALL-AMERICAN**  
Amplifying Transformers

The best known, most widely used transformers on the market. Standard on the better sets. Types—Audio Frequency, Radio Frequency, Power Amplifying (Input and Output). All the better dealers sell "All-American."

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*Pioneers in the Industry*

#### Special Offer

Book of tested hook-ups for getting new thrills out of your present outfit. Also, circuit diagrams and bulletin featuring Power Amplification. Send 2¢ stamp for postage. All-American Audio Frequency Transformers come in three ratios.



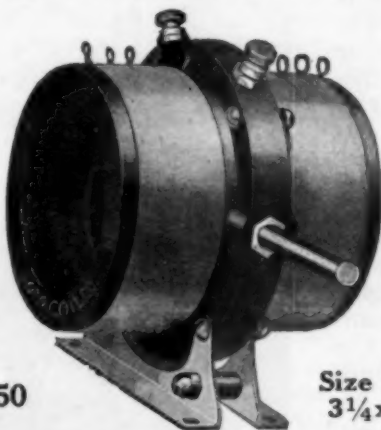
# Coto

"Built First to Last"

## Build Your Own Set and Build it Compact

Your radio dealer will recommend a good dependable and selective circuit. He will advise you, work with you, and make your success easy. A set assembled from Coto Compact Radio Parts, will be worth double its cost, especially next summer when you will carry it along on radio outings.

**Insist on Coto Quality Compactness**



**\$5.50**

**Size is only  
3 1/4 x 3 x 3 3/4**

### New Coto Compact Moulded Variocoupler

In polished brown bakelite. Range is 200 to 600 meters. Has eight taps for use with primary condenser. Pigtail connection to rotor. Base or panel mount. Type 9,000.

**Dealers! Jobbers!**

You can jump right into volume on the Coto Compact line because quality is right and demand established by national advertising.

## COTO-COIL CO.

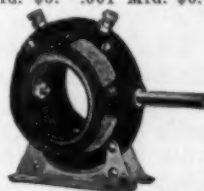
87 WILLARD AVENUE, PROVIDENCE, R. I.

### BRANCH OFFICES:

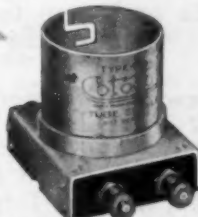
Los Angeles, 329 Union League Bldg.  
Minneapolis, Geo. F. Darling, 705 Plymouth Bldg.  
Atlanta, C. P. Atkinson, Atlanta Trust Co. Bldg.  
Canadian Distributors, Perkins Electric Co., Ltd., Montreal, Toronto, Winnipeg.



**Coto Compact Air Condenser with Vernier**  
Only 2 1/2 inches square. Rotor plates soldered to shaft. Stator plates soldered at three points. .0005 Mfd. \$5. .001 Mfd. \$6.



**Coto Compact Variometer**  
Especially designed for new wave lengths, 200 to 600 meters. Size 3 1/4 x 1 1/4 x 3 3/4 in. In brown polished bakelite with honeycomb wound stator. Pigtail connections to rotor. Base or panel mount. Type 8000. \$5.00



**Cotogrip Tube Socket**  
Has the unique double positive grip of tube terminal posts. Best hard rubber insulation. Type 7000. 85¢



**The Original Honeycomb Wound Coils**  
Popular low priced favorites of the amateur and experimenter.

## The Final Authority in Radio Frequency



**THE NEW JEFFERSON RADIO** Frequency Amplifiers need very little introduction. The name JEFFERSON is known wherever transformers are used. Both professional and amateur radioists are familiar with JEFFERSON Audio Frequency Transformers. They know from actual tests how superior they are to others and they have been waiting for a JEFFERSON Radio Frequency Transformer.

After many months of research and almost endless tests and experiments JEFFERSON Radio Frequency amplifiers have been pronounced by leading radio engineers to represent the very last word in this type of amplifier.

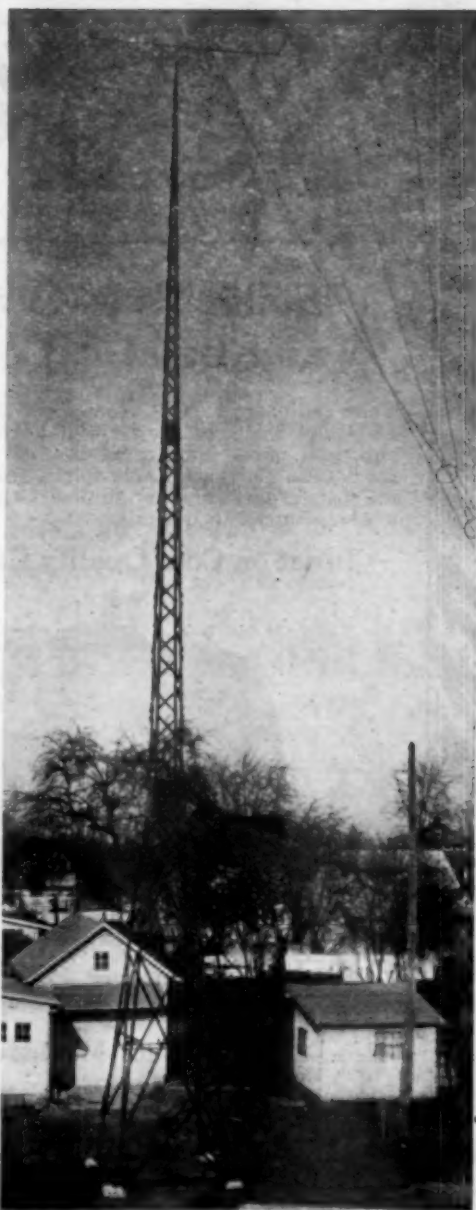
These new transformers cover the entire new wave length band (200 to 650 meters) and function with equal efficiency in standard Radio Frequency, Reflex, Inverse, Duplex or Neutrodyne circuits. Their scientific and careful construction sets a new standard for radio frequency amplification—the reasonable price appeals to all.

**No. 80 Jefferson Radio Frequency Transformer (1st stage) . . \$2.50**

**No. 85 Jefferson Radio Frequency Transformer (2nd stage) . . 2.50**

Descriptive bulletins, circuits and the recommendations of our Radio Engineering Department are at your disposal.

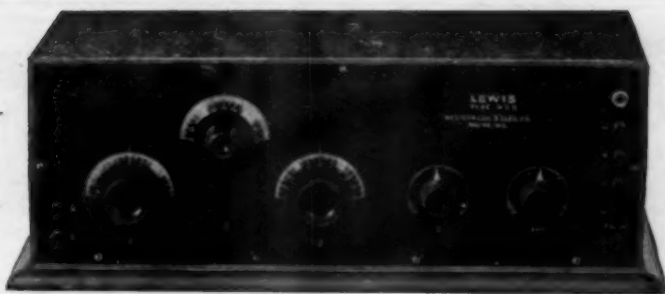
**Jefferson Electric Mfg. Co.**  
425 South Green St., Chicago, Ills.



We build only self-supporting masts. There are no ladders, platforms, unnecessary wind-pressure surfaces, guy ropes or wires or other unsightly features. These masts are graceful and stately—will dignify the most palatial surroundings. Built in three weights, **AMATEURS**, **STANDARDS** and **BROADCASTERS** carrying a strain at the top of 300, 1500 and 3000 pounds. The Mast-Head Pulley is "fool proof" eliminating the necessity of climbing up. The Cables twice the masts' length, will break before the Mast will. Our Wind-up Reels bring the antenna up to proper position. Patents pending.

**Whittlesey Engineering Co.**  
Cleveland, Ohio





## A Special Low Wave Set for Transmitting Amateurs

Does your receiving set respond readily to short wave signals? The WC-5-SW set shown above was designed by short wave specialists to help you. It picks up signals on wave lengths from 90 to 380 meters sharp and clear. The WC-5-SW has proven itself to be the most practical receiving set for low wave specialists.

### WC-5-SW

**Built Especially for Transmitting Amateurs**

The WC-5-SW is a 4 tube set. One stage of tuned Radio Frequency amplification is employed ahead of the detector to make it supersensitive. Two stages of audio frequency are used to bring up the signal strength. Uses any type of tubes. Gives perfect control of audibility. Detector rectifies only. Uses antenna compensating condenser. Only two control adjustments. Pure negative biasing on all tubes, thus marked saving on B Battery current. Tuned Radio Frequency sharpest known and most selective principle ever adopted. Plate potential non-critical. Mono-block tube socket. No grid plate leads on audio amplifiers. Audio amplification absolutely necessary when using low efficiency receiving antenna, i.e., underground or indoor. Mahogany cabinet, piano rub finish. Rabbited-in panel. Split lid cover. The price is \$85.00.

Write for complete description and illustrated folder on this practical set for low wave specialists. All transmitting amateurs will be interested in this literature.

### OTT RADIO, Inc.

224 Main Street

La Crosse, Wis.



Mounted Charger



100 Volt Panel Type

### Trinidad Government Pleased With KICO Efficiency

"We are ordering this battery on behalf of the Trinidad Government whose wireless officer was impressed with the efficiency of the Kic-o battery we are using with our receiving set." The above extract is only one of the many endorsements we are receiving of Kic-o Batteries. Alkaline type, won't sulphate or buckle. Life unlimited. Not harmed by short circuiting, over-charging or idleness. Panel switches give single cell variations. Recharge from any 110-volt A.C. line with small home rectifier. Charge lasts 3 to 6 months on 3 tube receiver.

#### GUARANTEE

Your money back on any KIC-O Battery if not satisfied within 30 days' trial. Write for full information on "A" and "B" Batteries.

Unmounted Rectifier ..... \$1.00

Mounted Rectifier ..... 2.50

**KIMLEY ELECTRIC COMPANY, Inc.**

2666 Main Street

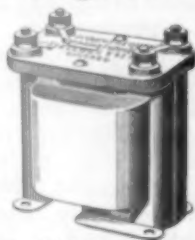
Buffalo, N. Y.

# K I C - O

Storage "B" Batteries—  
long service, low cost

Cells	Volts	Price, Plain	With Panels
16	22	\$5.50	
24	32	7.25	\$11.75
36	48	9.50	14.00
50	68	12.50	17.00
78	100	17.50	22.50
108	145	23.50	28.50

## Volume! Clarity!! Delight!!!



With Kellogg Shielded

#### Type Transformers

Furnishes distortionless amplification of all audio frequencies. Built complete by the Kellogg Company using highest grade wire, maroon enameled case, and molded Bakelite top.

Every Kellogg transformer is thoroughly tested before leaving the plant, and we guarantee the purchaser a product of exceptional efficiency.

No. 501—Ratio 4½ to 1—\$4.50 each

No. 502—Ratio 3 to 1—\$4.50 each

### KELLOGG SWITCHBOARD & SUPPLY COMPANY

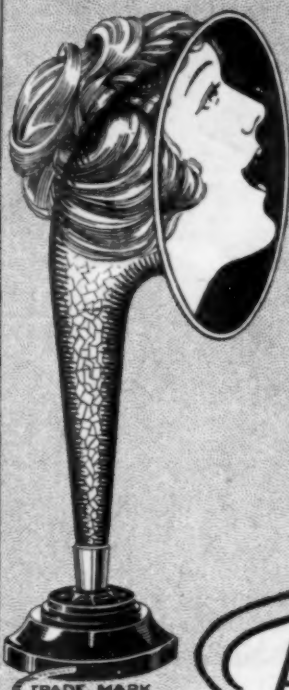
1066 W. Adams St., Chicago, Ill.

*Here are a few of the items we are selling off at greatly reduced prices. Send for complete list of bargains.*

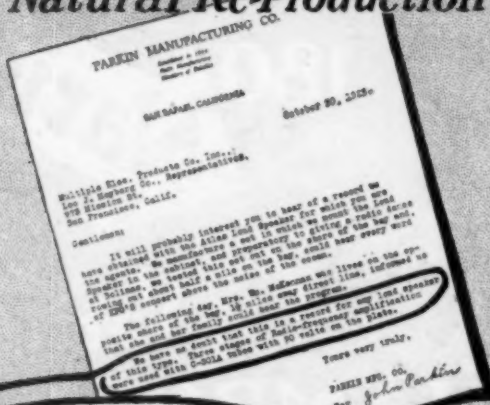
Type	Regular Price	Sale Price
Acme-fone Receiver with detector two-step amplifier and loudspeaker. Can be made regenerative at small cost.	\$60.00	\$30.00
HZ Clapp-Eastham Amplifier	35.00	15.00
JM-3 5-tube Radio Frequency Detector-Amplifier	95.00	30.00
JM-6 6-tube Radio Frequency Detector-Amplifier	130.00	40.00
RF DX Tuner for above radio frequency sets	35.00	10.00
No. 8 Federal Detector-Amplifier	52.00	20.00
No. 9 Federal Two-step Amplifier	58.00	25.00
20-A Firco Detector	27.00	8.00
No. 521 Kennedy Two-step Amplifier	55.00	40.00
No. 220 Kennedy Intermediate Receiver	125.00	75.00
No. 525 Kennedy Two-step Amplifier	85.00	65.00
No. 330 Remler Detector Panel	8.50	6.50
No. 331 Remler Amplifying Panel (without transformer)	6.00	5.00
No. 502 Remler Variometer Panel	10.50	8.00
No. 505 Remler Variocoupler Panel	12.00	10.00
CR-7 Grebe Long Wave Receiver (Slightly used)	210.00	140.00

### THE RADIO STORE

562 East Colorado St. Pasadena, Calif.



# Atlas LOUD SPEAKER *Natural Re-Production*



## A Record!

**E**NTHUSIASTIC TESTIMONY straight from an impartial authority. Re-Production is a *fact*. The delicate overtones which give music its roundness, resonance and timbre, are faithfully re-born through the modern magic of the patented "double diaphragm." This extremely responsive device is adjustable to the exact requirements of your set and individual receiving conditions. *Write for Illustrated Booklet "D"*

### Atlas Loud Speaker Unit

With Phonograph Attachment . . . . \$13.50  
Without Phonograph Attachment . . . \$12.50

### Letters From Users Requested

What have you accomplished with your Atlas Amplitone? Tell use about it.

Sole Canadian Distributors  
The Marconi Wireless Telegraph Company  
of Canada, Limited

Ask Your Dealer  
for a  
Demonstration

List Price  
Complete

**\$25**

**Multiple Electric Products Co. Inc.**  
ORANGE ST., RADIO DIVISION NEWARK, N.J.

**An Absolute Guarantee**  
with every instrument  
*made them famous!*

**SHAMROCK**  
FOR SELECTIVE TUNING

180°

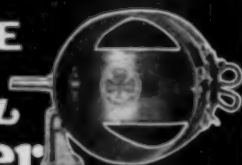
**Vario-Coupler**

List price,  
**\$3<sup>50</sup> each**



**DOUBLE  
DUTY  
PIG-TAIL**

**Variometer**



**SHAMROCK MFG. CO.**  
316 Market St. ~ Newark N.J.

## GENERAL ELECTRIC DOUBLE CURRENT GENERATORS

May Be Used as Dynamotors for C.W. Transmission

Driving Voltage	Plate Voltage	Mills
12	550	130
8	400	90

Made for the United States Army Air Service. Equipped with a Dubilier Filter System. Using 2 1/4 MF. 1800 volts Mica Condensers. Ball Bearings Equipped. All new, in original cases. Price \$29.75. Half Cash With Order—Remit by Money Order to Facilitate Immediate Shipment We also have: CW-936 Sub Chaser Telephone Transmitting and Receiving Sets including:—Remote Control System, Power Amplifier, Loud Speakers, Tubes, Spare Microphone, etc. Can be tuned down to 150 meters. Absolutely new sets. Navy Long Wave Tuners Type CN-240, Tuning Range 1000-30000 meters. You will want one for long wave reception—**SPECIAL PRICE \$75.00.**

**EKSAF TRADING CO., 1515 Eastern Parkway, Brooklyn, N. Y.**

**NESCO**

Complete line Radio Corporation Products, and popular parts for amateurs.

Mail orders given special attention.

Complete consultation at your service for the asking.

In emergency telegraph or call 3ZW, W. A. Parks.

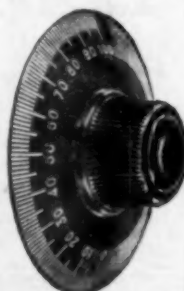
**National Electrical Supply Co.**  
1330 New York Avenue, Washington, D.C.

**NA-ALD**

DE LUXE DIALS

When phonographs were first made they were square boxes without ornamentation. Likewise the first dials, turned out in a laboratory,—had hard straight lines for shape. Beauty is a later development. Na-ald dials have soft, graceful lines which makes them very pleasing to the eye. They lead in both beauty and quality. They have the right grip for delicate, exact tuning.

**ALDEN MANUFACTURING CO.**  
Largest makers of Radio Sockets and Dials in the world  
Springfield, Mass.  
Dept. M 52 Willow St.



3 inch  
No. 3003—4  
35c, 3 for \$1.00





## Performance! — Read this Letter



**Receiver No. 102**      **Price \$95.00**  
(Licensed under Armstrong Patent 1113149)



**Audio Frequency Transformer, No. 50**  
Gives maximum amplification without distortion  
Ratio 3% to 1. Moisture proof  
**PRICE, \$4.50**



**Vernier Condenser, No. 10**  
Twenty-three plates, capacity .0005 M. F.  
Built-in vernier—low resistance and losses.  
**PRICE, \$4.50**

Melrose, Mass., November 10, 1923.  
National Chelsea Radio Corp., Boston, Mass.  
Gentlemen: I know that you will be interested in the remarkable reception which I obtained with one of your Type No. 102 Regenerative Receivers.

I received the instrument Friday, November 2, and connected it in the presence of two of the Boston Edison Company's engineers. On this evening without any previous experience, I heard practically every station throughout the Middle West on a loud speaker. I am very much delighted with the performance of this receiver.

I am attaching below a list of stations which I have heard during the past six days. All of these stations were received on the loud speaker with sufficient volume to be heard all over my home with the exception of Denver. Nearly all of these were received prior to 10 p. m.

WOC	Davenport	WJZ	New York City
WOAI	San Antonio	WOS	Jefferson, Mo.
KLQ	Denver	WCAU	Phila., Pa.
WHN	New York City	WFI	Phila., Pa.
KHJ	Los Angeles	WNAC	Boston
WFAA	Dallas	WGI	Medford
WDAR	Phila., Pa.	WDAP	Chicago, Ill.
KDKA	Pittsburgh, Pa.	WTAM	Cleveland, O.
WRC	Washington, D.C.	WLAG	Minneapolis
WEAF	New York City	WHW	Cincinnati
WOR	Newark	KQW	Pittsburgh
CFCF	Montreal	WIP	Phila., Pa.
WGY	Schenectady	WCAE	Pittsburgh
WBZ	Springfield	WWJ	Detroit
WHAZ	Troy, N. Y.	KYW	Chicago
WCBD	Zion, Ill.	WDAP	Chicago
WAAM	Newark, N.J.	WSB	Atlanta
WGR	Buffalo	KSD	Kansas City
	WHAS		Louisville

Assuring you that I am an enthusiastic booster of Chelsea Receivers I remain

Yours very truly,

AUDREY R. GOODWIN

You can secure the same results with this wonderful Chelsea Receiver.

### CHELSEA PARTS

The marvelous results obtained by CHELSEA RECEIVERS are largely due to the Chelsea Parts. If you are building your own set you may be certain that the use of Chelsea Parts will give you the maximum results.

Write for our large Catalog No. 4 illustrating a complete line of sets and parts

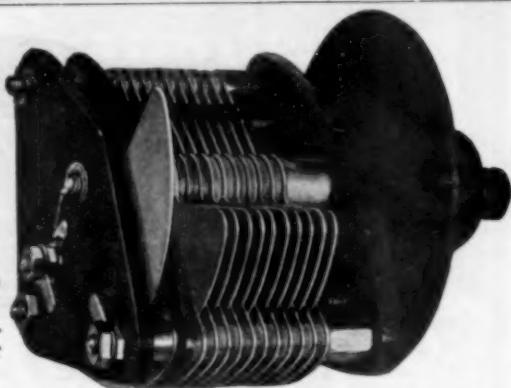


# The New SIGNAL

Vernier

Variable

Condenser



A Vernier Variable Condenser with positive contact between vernier and rotor plates.

Here is a condenser which ends your troubles. The closest tuning can be obtained with the Vernier the entire range being 2-1/100 of the larger dial. The contact between the Vernier and rotor plates is a special bushing insuring positive con-

tact at all times. Vernier adjustments, close tuning, never before obtained can now be yours. Distant stations, elusive and hard to get, can be brought in clear and strong.

*Ask your dealer, to show you the New Signal Vernier Variable condenser. Catalog on request.*

## SIGNAL Electric Mfg. Co.

Factory and General Offices  
1915 BROADWAY,  
MENOMINEE, MICHIGAN

Boston,

Chicago,

Cleveland,

Minneapolis,

Montreal,

New York,

Pittsburgh,

St. Louis,

San Francisco,

Toronto,

Philadelphia,

Los Angeles

You'll find our local address in your Telephone Directory



Standard  
of  
Excellence  
for audio amplification  
With all tubes  
In all stages

## AMERTRAN

TRADE MARK REG. U.S. PAT. OFF.

*Improve your set with an AmerTran*

Its flat-top, distortionless amplification curve assures a pure tone rendering of the full musical scale.

It amplifies in one stage from 30 to 40 times in the flat part of the curve, depending on the tube constant—the amplification is approximately 5 times the tube constant. Send for Circular 1005.

Type AF-6; Turn ratio 5:1. Price \$7. Ask your Electrical Dealer; or, sent carriage charges collect.

**American Transformer Co.**

Designers and builders of radio  
transformers for over 25 years

176 Emmet Street,

Newark, N. J.

**FERBEND**  
Wave Trap  
TRADE MARK  
PATENT APPLIED FOR

The  
**Original**  
Wave  
Filter

**Stops Interference!**

Eliminates interfering stations.  
Improves the selectivity of the set.  
Eliminates local broadcasting.  
Selects between conflicting stations.  
Simplifies tuning.

Often increases signal strength.  
Reduces howling and squealing.  
The WAVE TRAP is mounted on a Formica panel in a beautiful mahogany finished cabinet 6x5x8, and is a high grade instrument throughout enhancing the appearance of the most expensive sets.

**850** Ferbend Electric Co.  
CHARGES PREPAID 23 E. SOUTH WATER ST.  
**CHICAGO**  
Circular on Request

## Why do you do it?



## Is your battery always fully charged and fit?

Is it always toned up for best results, whenever friends happen in—throughout every concert?

Keep it at full strength and prolong its life—the simple, easy, inexpensive Tungar way.

Tungar—the go-between from house-lighting circuit to storage battery—attaches wherever there is a lamp or convenience outlet.

You don't have to move the battery. Just connect Tungar, and leave it—any time, day or night.

Tungar is *certain, clean, quiet*. No moving parts to get out of order or make noise.

Good for the auto battery too—the same Tungar.

See one at any good electrical store, or write for literature. Address Section Q1

Merchandise Department  
General Electric Company  
Bridgeport, Conn. Section Q1

**Tungar Battery Charger.** Operates on Alternating Current.

2 Ampere Outfits—\$18.00

5 Ampere Outfits—\$28.00

(Prices east of the Rockies)

Special attachment for charging 12 or 24 cell

"B" Storage Battery—\$3.00

—fits either size Tungar.



Charge 'em at Home, with

# Tungar

## BATTERY CHARGER

A GENERAL ELECTRIC PRODUCT

15A-96C



## TESTS PROVE IT BEST!

**E**XPERTS marveled when they tested the SAMSON HW-A1 Audio Frequency Transformer. Never had they used an audio frequency transformer which gave them such remarkable results! One stage of amplification with a SAMSON proved far more satisfactory, in most cases, than two stages of some and better than three stages of other transformers. No howling.

### **Samson** HW-A1 AUDIO FREQUENCY **Transformer**

You need the results which a SAMSON gets you. Insist on a SAMSON from your supply dealer; if he hasn't it we'll ship one, prepaid, on receipt of \$7.00. Ratio 6 to 1.

#### Helical Winding Does It



Here is the secret of SAMSON'S success. Note that the wire is laid in layers without paper insulation. This reduces the distributed capacity to an absolute minimum, increases amplification, eliminates distortion. Helical Winding exclusive with the SAMSON.

Made by

**SAMSON ELECTRIC CO.**

Factory: Canton, Mass.

Sales Offices:

Boston, New York, Philadelphia, Pittsburgh,  
Chicago, Cleveland, Detroit, Indianapolis, St.  
Louis, Atlanta, Minneapolis, San Francisco,  
Los Angeles, Seattle, Portland, Montreal,  
and Toronto.

## IF YOU CAN'T BUY THEM AT YOUR DEALER'S SEND DIRECT TO US

"Red-Heads" are guaranteed radio phones. You run no risk when you buy them. Moneyback if, after 7 days' trial, you're not satisfied that they're the best receivers on the market at the price. Why not act *right now* and get a pair? It'll mean getting the maximum from broadcasting from the day you put them into use.

### RED-HEAD RADIO RECEIVERS



These remarkable head-sets are made by The Newman-Stern Co., one of the pioneer radio manufacturing houses in America.

#### JUST OUT

The new 1924  
Model F

**\$6.50**  
PER PAIR  
Complete

This is the standard 3,000 ohm "Red-Head." The 1924 Model F has eleven improved features. Sensitive and fine-tuned; aluminum case; famous brown-red ear caps; military headband; high-grade cord.

The new 1924  
"Red-Head" Jr.

**\$5.00**  
PER PAIR  
Complete

The Junior Model has most of the quality features of the standard Model F here described. The resistance is 2,000 ohms per set instead of 3,000 ohms. A remarkable value.

"Red-Heads" sent prepaid on receipt of price if you are unable to get them at your dealer's.

THE NEWMAN-STERN COMPANY  
Dept. QS Newman-Stern Bldg. Cleveland

## CATALOG E19-112 PAGES FREE

### EVERYTHING IN RADIO

One of the largest complete stocks in the world. 40 diagrams of latest Hookups.

### DEALERS ALL OVER THE U.S.

Making big profits handling our supplies. 24-hour service. Goods shipped same day order received.



WHOLESALE RADIO DISTRIBUTORS

Dept. "T" 107 E. 13th St. Kansas City, Mo.



# Impartial Experts Testify!

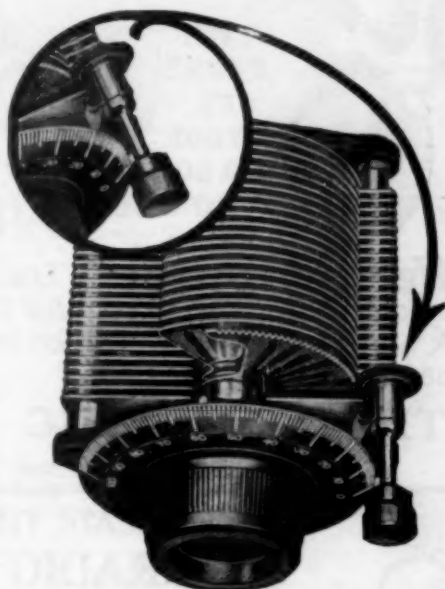
For a long time, set builders have wanted some definite, authoritative guide to condenser quality. Complying with this demand, HEATH RADIANT CONDENSERS were submitted to two of the greatest radio testing laboratories. Below are salient phrases from their reports. Copies of the complete reports free to anyone interested.

## Electrical Testing Laboratories of New York Say—

" . . . the equivalent series resistance of each of the condensers is very small. That is, it is *so small* that it may be considered as *negligible*."

## Radio News Laboratories Say—

" . . . considered one of the best condensers we have tested. A dielectric loss resistance of 46 ohms at 1000 cycles . . . "



# HEATH RADIANT CONDENSERS

### Permanently Flat Plates

*Precise*, when you examine it at the store and, still more important, *p-r-e-c-i-s-e* *always*, for years—the most durable, continuously efficient part of your set. Warping plates made *impossible* by the Heath process of stamping and hardening which makes each one permanently F L A T—.

### Micrometer-Adjusting Geared Vernier

Reducing gear, engaging with teeth cut into the outer rim of the vernier plate, affords infinitely delicate adjustment. An added feature of satisfaction that makes it well worth your while insisting upon *Heath Radiant Condensers*.

*Write for Booklet*

List Price—Vernier Type—(with 2 $\frac{7}{8}$ " dial and knob)

13 Plate \$5.00

25 Plate \$5.50

45 Plate \$6.50

**HEATH RADIO & ELEC. MFG. CO.**

207 First Street

NEWARK, N. J.

**WEIGHS  
ONLY  
8 OZ**



**A \$200,000.00 COMPANY**  
stands squarely back  
of the guarantee on  
every *Scientific* headset

**SEND NO MONEY!**

**20,000 TURNS  
EQUIVALENT TO  
3,000 OHMS**

**Order TODAY  
by Postcard  
and Pay  
Postman  
on arrival**

**THE  
PHONE  
IT  
TOOK  
A SOLID YEAR  
TO DESIGN**

**\$2.95**  
**POST-  
PAID**

**LOUD  
SPEAKER  
UNIT \$1.95**

**We Guarantee** The *Scientific* Headset to be the greatest value on the market. Try it for five days. If not satisfactory send it back and your money will be refunded immediately. Circular on request. Dealers wanted.

## THE SCIENTIFIC ELECTRIC WORKS

98 Brookline Ave.

DEPT. G

BOSTON, MASS.

### WE REPAIR THE FOLLOWING RADIO TUBES and Guarantee Them



WD-11	.....\$3.50	UV-199	.....\$3.50
WD-12	.....3.50	C-299	.....3.50
UV-200	.....2.75	UV-201A	.....3.50
UV-201	.....3.00	C-301A	.....3.50
C-300	.....2.75	UV-202	.....4.00
C-301	.....3.00	C-302	.....4.00
DV-6	.....3.00	DV-6A	.....3.50

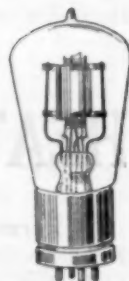
Mail Orders solicited and promptly attended to.  
Dealers and Agents write for Special Discount

**H. & H. RADIO CO.**

P. O. BOX 22-W

CLINTON HILL STA.,

NEWARK, N. J.



### HYGRADE SPECIALS

Skinderviken Transmitter Buttons	.....\$ .95
No. 763 Eveready 22½ V. Variable B. Bat.	1.25
No. 766 Eveready 22½ V. Variable B. Bat.	1.98
No. 767 Eveready 45 V. Variable B. Bat.	3.98
2000 Ohm Murdock No. 56 Head Sets	3.50
3000 Ohm Murdock No. 56 Head Sets	4.25
Federal or Brandes Head Sets Complete	5.50
Dictograph 3000 Ohm Head Sets	5.98
Acme Amplifying Transformers	3.75
Acme R.F. Transformers, Types R2-R3-R4	3.98
6 Volt Marko Storage Batteries	8.95
Firco (Bull Dog Grip) Phone Plugs	.75
Federal Amplifying Transformers	4.75
23 Plate Var. Cond. Bakelite Ends	1.49
43 Plate Var. Cond. Bakelite Ends	1.95
No. 164A Fada Neutrodon Condenser	.98
No. 163A Fada Neutroformer	6.49
No. 165A Fada Hazeltine Parts	21.50

All orders must include Parcel Post charges

**Hygrade Electrical Novelty Co.**

41 West 125th Street

New York, N. Y.



### RADIO "B" BATTERIES At Factory Prices

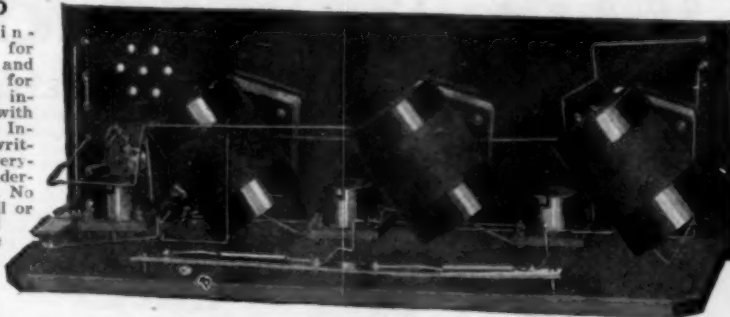
Greatest radio "B" battery on market. Full number voltage taps; **QUALITY GUARANTEED**; **LOWEST PRICES**; brings in concerts **LOUDER AND STRONGER**; will work on any tube or loud speaker. Order by number **TODAY** with check, money order or pay postman C. O. D.  
No. 222B 22½ volt variable, regularly \$2.25 .. \$1.52  
No. 222A 22½ volt variable, regularly 3.00 .. 1.85  
No. 245A 45 volt, 8 taps, regularly 5.50 .. 3.25

**AYRES BATTERY CORPORATION, Cincinnati, Ohio**

## Build a receiver where the numbers on the dials have a real meaning—

### EASY TO BUILD

Complete instructions for assembling and blue-prints for wiring are included with each outfit. Instructions written so everyone can understand them. No special skill or technical knowledge required.



### PANELS DRILLED FREE

Specially drilled panels are included with each of the sets illustrated and described below. We give this free service only on panels included with complete sets.

### HAZELTYNE NEUTRODYNE

(With Fada or Freed-Eisemann licensed parts)



- 1 7 x 21 x 3-16 drilled Formica panel.
- 1 Howard rheostat.
- 3 4-inch Radion Dials.
- 3 John Firth bakelite sockets.
- 8 Binding posts.
- 3 23 plate variable condensers.
- 1 Wave control neutroformer.
- 2 Radio frequency amplifying

3 TUBE  
\$28.60

4 TUBE  
\$44.65

5 TUBE  
\$46.25

- neutroformers.
- 2 Grid neutralizing condensers.
- 1 .00025 micron grid condenser.
- 1 Marco variable grid leak.
- 1 Baseboard for mounting.
- 25 feet tinned copper bus bar wire and complete instructions for assembling and wiring.



\$10.00  
Value

### Western Electric VT-2 TUBES

One of the big features of these brand new genuine Western Electric VT-2 Tubes that we bought from the U. S. Signal Corps is that they have a higher amplification factor than any other 5-watt tube made! May be used for both RF and AF Amplification and for CW and phone transmitting. Not Navy defects; they have been sold only as a surplus. **\$7.45**

## FORMICA

Made from Anhydrous Redmanol Resins  
SHEETS TUBES RODS

We are prepared to furnish promptly and saw Formica panels of any dimensions. Cutting charge is included in the following price:  
3-16-inch Formica, sq. in. .2¢  
1/4-inch Formica, sq. in. .1¢  
Tubing (all diameter),  
per running inch. ....10¢



### What "Salvage" Really Means---

Sometimes a manufacturer over-produces and must sacrifice his surplus stock for cash. Sometimes a dealer misjudges market conditions and must unload—again for cash. Our business is to buy—to "Salvage"—these special offers by paying spot cash for the entire surplus. But in order for us to keep on taking advantage of such offers, we must make a quick turnover. That is why for example we offer you the \$10.00 Automatic Electric Headset for \$3.65. "Salvage" to us does NOT mean something that has been used. We handle no second-handed merchandise. Every item we sell is guaranteed brand new—in fact 95% of our merchandise is in the manufacturers' own carton and carries his guarantee along with ours. "Salvage" to YOU means buying quality radio merchandise for less.

### Automatic Electric HEADSETS

Formerly sold by the Automatic Electric Co., makers of telephone exchanges, at \$10 each. We bought their entire stock—40,000 phones—paid spot cash and because of this unequaled buying power, we are able to offer you a \$10 headset for \$3.65. 30 years of experience have produced the Automatic headset. Coil is wound with about 6500 turns of No. 40 enamel coated copper wire. DC resistance 1600 ohms. Impedance, at average music and voice frequency (800 cycles) 21,000 ohms. (Effective impedance rather than DC resistance is the big factor in a good headset.) **\$3.65**

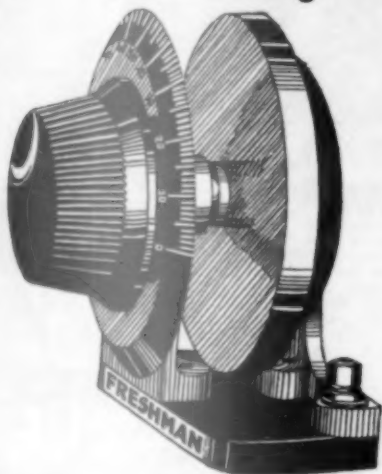
### Genuine Western Electric MICROPHONE

Including:  
6 ft. of cord  
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Breast Plate  
Shoulder Straps  
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Special at **\$1.95**



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*A Variable Condenser,*  
*the plates of which*  
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*an engineering feat*  
*never accomplished*  
*before—giving especially*  
*fine adjustment for*  
*selective tuning.*



*For*

### **Transmission or Reception**

The highest class Variable Condenser,  
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Will stand more than 5,000 volts.

Plates are dust and dirt proof, thereby eliminating leakage which creates noises. No plate vibrations—absolutely quiet. Compact and attractive in appearance. Mercury plates give intimate contact with Mica Dielectric.

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*Can be Made*

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**18 Stock Sizes  
Radion Panels**

*Mahoganite and Black*

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7 x 9	7 x 10	7 x 12
7 x 14	7 x 18	7 x 21
7 x 24	7 x 26	7 x 48
9 x 14	10 x 12	12 x 14
12 x 21	14 x 18	20 x 24



Look for this  
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genuine RAD-  
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ware of substi-  
tutes and imi-  
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(Registered)

### In your radio set assure—

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music with its delightful and thrilling modulations—  
speeches without distortion, audible down to a whisper—  
and all the other joys of Radio at their best

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At your dealer or direct by mail.  
Write for complete literature.

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Exclusively for the

**O. & T. Electric Corporation**

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Fully guaranteed.  
Beware of imitations.



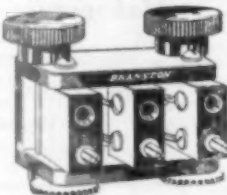
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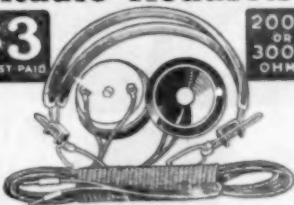
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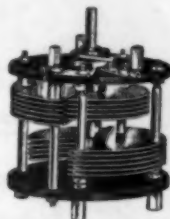
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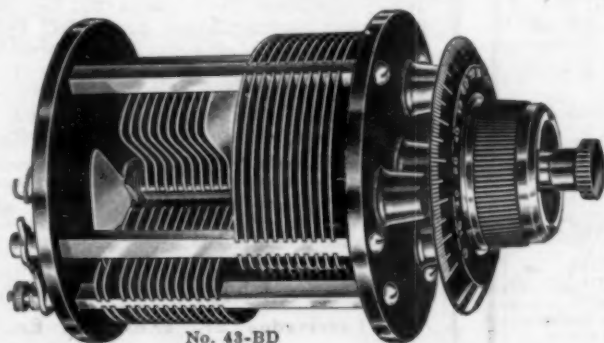
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Tube characteristics are not alike. The Vari-Grid varies the capacity of the tube. Has variable grid leak. Also used as a plate condenser. 1 3/4" wide, one hole to drill.

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RADIO ACROSS ATLANTIC. Get ready for it. Learn synthetic language. Very easy. Circulars free. Russell Bennett, Radio Editor, Boston Advertiser, Boston, Mass.

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BARGAINS—Three circuit tuner and detector \$25, in cabinet; Three circuit tuner, detector and two stage audio frequency amplifier in cabinet \$50; Federal pleiophone loudtalker \$5. Elmer Bean, Comfrey, Minn.

SELL: 2 Radio Corporation amplifying transformers @ \$5; 1 Federal \$5.00; 2 used UV-201 @ \$3.00; 1 unused UV-201 \$5; 1 new WD-11 with adaptor \$5.00; 4 pair slightly used Brandes Superiors @ \$4.50; 1 single Baldwin type C \$4.00; Tesco 20,000 meter coupler \$5.00; 2—11 plate and 1—23 plate condensers @ \$1.00; 2 low loss variometers @ \$3.00. A. Benesowitz, 415 McKinley St., Hibbing, Minn.

TELEFUNKEN TRANSMITTING TUBES Genuine guaranteed 30 Watt \$15, 20 Watt \$12.50, Filament 2 amps., Plate 800 volts. C.O.D. or money order. Edison elements 5¢ pair. Arthur Beyer, 106 Morning-side Drive, N. Y. C.

PURE SHEET ALUMINUM and lead  $\frac{1}{8}$ " 75¢ sq. ft. Electrical Specialty Co., Valparaiso, Ind. 9DVK.

FORTY DOLLARS takes my 3-circuit receiver. Silk wound variocoupler and variometers, vernier adjusters, back mounted switch, square bus wiring, vernier rheostat, 199 socket, Freshman leak and condenser, engraved panel, large dials, hard rubber posts, jack output, cabinet and tube. J. C. Gilliland, Westmount, Johnstown, Pa.

SELL: NAVY type IP-500 receiver, perfect condition; same as in Radio Corporation catalogue listed at \$595.00. First money for \$160.00 takes it. Also Radio Corporation Magnetic Modulator  $3\frac{1}{2}$  to 5 Ampere size, \$8.00. Earl Brockway, 930 Belmont Ave., Flint, Mich. (8AGG)

RADIO BARGAINS: Any \$6.50 tube \$5.75; Burgess 2156 batteries \$2.50; Erla Reflex transformers any type \$4.50; Brandes Superiors \$5.25; Signal 23 plate condensers \$1.75; Audio transformers \$3.00 to \$6.50; Neutrodyne and Reflex sets and parts; Complete line of accessories at bargain prices, everything guaranteed perfect. Edward Bromley, Jr., White-water, Wis.

BARGAINS: France chargers; for "A" batteries, nine dollars; for "A" and "B" batteries, twelve dollars. Eber C. Byam, 7023 North Paulina Street, Chicago, Ill.

RUBBER STAMP with large call letters 50¢; Radiogram and Relay Radiogram blanks 25¢ per hundred, Post Card 60¢ hundred. Send us your orders. Carolina Printing & Stamp Co., Wilmington, North Carolina.

FOR SALE: Clapp-Eastham regenerative set, unmounted, \$10; 11 honeycombs (25-400) with receptacle, brand new, \$15; 2 pairs Mudcock phones, \$2.50 each; 2 43 plate, 1 17 plate variable condensers, \$1.50 each; also tubes, amplifying transformers, etc. Cheap. Everything excellent condition. Write for information. Gordon Carr, Batavia, N. Y.



**AMATEURS! HAMS! WE ARE MAKING A NEW STANDARD OF PRICES ON "SIG" CARDS. QUANTITY PRODUCTION MAKES THIS POSSIBLE. CARDS 3 1/2 by 5 1/2 ON CREAM CARDBOARD OR GOVERNMENT POSTAL IN BLACK INK WITH LARGE RED CALL LETTERS. NOT OVER TEN LINES OF PRINTING. PRICE PER 500 ON CARDBOARD \$4.00; GOVERNMENT POSTAL (we furnish them) \$8.50. NOT LESS THAN 500 PRINTED AT THESE RATES. CASH WITH ORDER, NO STAMPS, NO C.O.D. MEMBER A.R.R.L. CURTIS, 1109 EIGHTH AVENUE, FORT WORTH, TEXAS.**

**FOR SALE:** A few 23 and 43 plate condensers at factory cost, \$1.25 and \$1.75. Metal end plates. Hard rubber insulation. Well made and reliable. Circle C Producers, 1431 W114 St., Cleveland, Ohio.

**FOR SALE:** Brand new Westinghouse TF Transmitter. 10 watt phone—20 watt C.W. Complete with Microphone, four tubes (never opened) 100 watt Motor-Generator and key. Above transmitter was on test with phone two nights and was reported in fifteen States. Modulation perfect. First certified check for \$175.00 gets it. H. B. Wooten, Coldwater, Miss.

**PROTECT YOUR APPARATUS** with small fuse wire in dangerous places. Eighth, quarter, half, three-quarter, one-ampere and larger sizes, three feet for two bits. 9CZP.

**SACRIFICE:** Reinartz tuner \$15, detector and two step deluxe with Radio Corp. transformers, etc., \$50, with Radiotrons \$65. Heard 46 states two months. 43 plate variable \$2, one step audio \$6. Broadcast receiver with UV199 tube \$25. Detert, 1112 East Fifth St., Duluth, Minnesota.

**PARAGON RA10** latest type \$38. 200 watt, 500 volt Robbins & Meyers Motor Generator telephone set, mounted on board, 4-5 watt tubes, 3 meters, De Forest variable microphone transformer, etc., modulation perfect. Price \$150.00. 500 watt 1500 volt Acme plate transformer \$15. Clapp-Eastham Det. & 2 step, HZ, \$20; Magnetic modulator 3 1/2 amps., \$7.00. Richard A. Donnelly, 2CPD, Brielle, N. J.

**MASTER RADIO CODE** in 15 minutes. Ten word speed 3 hours. Our students made these world records. Previous Failures who tried all known methods have thanked us for License. To hesitate kills speed. To master Code our way kills hesitation; gives speed. Code instructions that instruct only \$2.00. Information free. Dodge Radio Shortcut, Dept. SC, Mamaroneck, N. Y.

**PARTS** for Copp circuit \$6.00. R. Earhart, 2722 Hampshire, Cleveland, Ohio.

**SELL:** Grebe RORN forty dollars; ten watt C.W. set complete seventy dollars. Connecticut variable condenser three dollars, J tube four dollars. Howard Eldredge, Sharon Springs, N. Y.

**BARGAINS:** 5 Watt tubes \$6.95. Electric Soldering Iron \$1.95. Many other Bargains. Send for RADIO BARGAIN BULLETIN. The Electric Shop, Secor, Illinois.

**WAVEMETERS** and filter, range 150 to 500 meters, 2% accurate, \$6.00. Electrical Specialty Company, Valparaiso, Indiana.

**"WARRANTED" C.W. TRANSFORMERS** new and ten day's money back guaranteed. 500 watt plate transformers taps 500, 1000, 1500, 3000 volts unmounted \$13.00. 200 watt, high voltage 350, 550, 700 volts, filament voltages 2, 4, 6, 8, 10, 12 volts-unmounted, \$10.00. 50 watt high voltage 375 filament voltages 8, 10, unmounted \$7.00. Filament transformers, 150 watt voltages 8, 10, 12, \$7.00. Chokes 500 M.A., 1 1/2 Henry-unmounted, \$3.00. Order direct from this ad. Dealers write. C. C. Endly, 22 Sturges Ave., Mansfield, Ohio.

**RCA UL-1008 Oscillation Transformers** @ Nine Ninety Prepaid. I sell all Radio Corporation products at 10% off list, and ship same prepaid. Edward Gieseke, Radio 9EBH, 312 So. Liberty St., Elgin, Ill.

**SELL OR TRADE:** Esco 750 volt, 150 watt motor-generator, D.C. drive. \$50 or trade for Paragon RA-10, Grebe CR-8 or what have you? Gilman, 8CZC-8ADQ, 8932 Quincy Ave., Detroit.

**FIRST CHECK FOR \$40.00** takes 200-watt Acme, 8-volt filament transformer, two 2MF Acme condensers, two 5 tubes and sockets, two Merphon condensers; \$16.00. 50-H choke coil ala QST, fuse block and changeable fuses. Discarding phone set. J. C. Gilliland, Westmont, Johnstown, Pa.

**SPECIAL THIS MONTH.** UV-1714 R.F. Transformers for the Super at \$6.50 each. Also Amertran Audio Transformers at \$6.25 each. Will ship Parcel Post C.O.D. if you wish. Let me quote you on any parts you need. Gillmore Radio Shop, 46 Thomas St., Newark, N. J.

**HOMCHARGER,** slightly used. Improved type Good condition, \$9.50. H. Greenman, So. Haven, Mich.

**FOR SALE:** UV-204, \$65. Practically new. Have installed larger transmitter, Thompson Guernsey, University of Maine, Phi Kappa Sigma, Orono, Me. 1EE.

**FOR SALE CHEAP:** 1 500-volt 200-watt ESCO dynamotor new, 110 volt, D.C. drive. P. Goetz, 5612 Post Road, Riverdale, N. Y. C.

**EDISON STORAGE "B"** Battery Elements. Large size, full capacity. 3¢ per pair, in lots of 100. Kindly send postage for 5 1/2 lbs. Per 100 pair. Gilman's Battery Shop, 57 Washington Ave., Chelsea, Mass.

**FOR SALE:** No. 125 Goodell Pratt bench lathe with 1/4 H.P. motor and complete equipment for metal and wood turning. \$85 value for \$65. 10337 Avenue J, Chicago, Ill.

**WANTED:** All A.R.R.L. members to know that we have a complete stock of radio parts and give mail orders special attention. Write, phone or wire. Hardsoc Mfg. Co., Radio Division, K.F.J.L., Ottumwa, Iowa.

**SELL:** New Amrad Regenerative, Amrad detector two step \$60, Cost \$125. Two step \$30, RCA 5 ampere hotwire \$4. General Radio 2 ampere hotwire \$4. Three new WD12's \$4.50 ea. Pair Baldwin type G \$10. RCA 325 watt C.W. transformer \$15. Sickness, must sell. Hatry, Port Arthur, Texas.

**WANTED:** Fifty watt tube! What have you? L. Hecht, 1744 Chicago Ave., Evanston, Illinois. 9ED.

**GREBE DIALS,** 4" Tapered Grip, \$1.50; Nathaniel Baldwins (C) \$10.00, Singles \$5.00; DeForest Vernier Condensers .0015 \$12—.001 \$11, UV199 WD11, WD12, UV201A, \$5.95, King Amplitone Horns \$6, Pathe Molded Variometer or Variocoupler \$3.75, Erla Reflex Transformers \$4.50, Samson Transformers \$6.50, Pathe Dials, almost duplicates of Grebe 4", \$1.25; 3", \$1.00; Rheostat Dial \$0.90, Thordarson Transformers 3-1 \$3.50, 6-1 \$4.15, Federal 65 \$6.75, Acme Radio or Audio \$4.25, Murdock Phones 2000 \$3.75, 3000 \$4.25, All-Wave Couplers \$6.50, Push-Pull Transformers set \$12.50, Fada Triple Sockets \$2.75, Brandes Superiors \$5.25. Everything Postpaid. Write for prices on anything in the radio line. Dealers, get our discount sheet. Hendrick Radio Equipment, 85 West 181 Street, New York City.

**EXCELLENT Magnavox 2-stage amplifier,** \$40. 8DDA, Canton, N. Y.

**FOR SALE—ALL NEW GOODS.** 1 550-volt, 700-watt Generator with Field Rheostat \$40.00, 1 Thordarson 1-KW Transformer with two 1500-volt Secondaries \$15.00, 2 Deveau Indoor Telephones \$5.00, 1 Acme Portable Moving Picture Projector Electric Drive with 5000 feet film \$100.00, 1 Thordarson 80-watt Filament Transformer \$7.50, 1 1/2 H.P. A.C. Motor with Chopper Rotor on shaft \$20.00, 1 Automatic Double Tape Recorder \$20.00, 4 Amrad 5 Tubes @ \$5.00, 4 Amrad Filter Condensers @ \$5.00, 4 R.O.C. 50-watt Tubes @ \$24.00, 3 R.O.C. 250-watt Tubes @ \$75.00, 4 50-watt Sockets @ \$2.00, 1 ESCO Generator 225-watt 500-volt plate and 10-volt Filament \$40.00, 12 Hoyt Peep Hole Meters 0 to 1.2 Amp. \$2.00, 12 Hoyt Peep Hole Meters 0 to 10 volts \$2.00, 1 Jewell 0 to 2 1/2, 1 Jewell 0 to 5, 1 Jewell 0 to 10, 1 Jewell 0 to 15 Thermo Ammeters @ \$9.00, 1 Splitdorf 0 to 1500 Volts D.C. Meter \$17.00, 1 Splitdorf 0 to 500 volts D.C. Meter \$9.00, 1 Thordarson 300-watt Filament Transformer \$10.00. FOLLOWING USED: IN FIRST-CLASS CONDITION. 1 1/4 KW Clapp-Eastham High tone Set \$50.00, 1 1/2 H.P. Bali Bearing Synchronous Motor in 1 HP Frame \$40.00, 1 Electric Blower (poor condition) \$7.50, 1 500-volt, 100-watt Motor Generator \$45.00, 1 Small Power Hack



Saw \$10.00, 1 Dubilier Condenser .01 M.F. 10,000 Volts \$8.00, 1 Dubilier Condenser .01 M.F. 25,000 Volts \$12.00, 12 U.C. 490 1 M.F. Filter Condensers \$2.00, 12 U.P. 1627 1/2 M.F. Filter Condensers \$1.50, 1 R.O.C. Transmitting Inductance \$7.50, 1 10-Henry Choke 1 Amp. Capacity \$15.00, 1 4-Henry Choke 1 Amp. Capacity \$8.00, 1 2-Henry Choke 1 Amp. Capacity \$4.00, 1 1/2 H.P. Motor Generator 100-A.C. to 90-volts D.C. \$35.00, 1 1/2 H.P. 110-volts G.E. Motor \$35.00, 1 150 Ohms Bunnell Relay \$2.00, 1 Thordarson Oil Transmitting Condenser .01 M.F. \$5.00. Terms: C.O.D. One-fourth Cash with Order. G. L. Hight, Rome, Georgia.

**BARGAIN:** 500 Volt 100 Watt ESCO motor-generator like new, first check for \$68.00 brings it to your shack. R. H. Horn, Box 605, San Luis Obispo, California.

**BARGAIN:** Omnigraph, fifteen dial \$15.00. Grebe 8, \$50.00. Rork, \$30.00. Also tubes. All good condition. J. Hudlow, Gold Hotel, Salt Lake City, Utah.

**SALE:** Frost Hand Microphone, \$4.50; Gen. Rdo. Modulation Trf., \$3.50; 2 Lead-In Bushings, 15"x 1", \$3.30; 2 Federal Filters 300W, \$10.50; 2 Filter Condensers 1500 V., \$2.80; 8 Faradon Condensers 750 V., \$11.20; Thordarson Fil. Heat Trf., \$4.90; Gen. Rdo. HW Meter 0-2.5, \$5.35; Grid Leak 5000 Ohm, \$0.80; 4 Gen. Rdo. Sockets, \$3.50; Somerville Milli-ammeter 0-500, \$5.65; Jewell Milliammeter 0-500, \$5.65; Jewell D.C. Voltmeter 0-1000V, \$15.75; Power Rheostat 42 Ohm, \$2.00; Esco M.G. Set 500V. 250 Watts, \$74.00; 2 Lightning Switches & Pedestals, \$4.00; 4 5-Watt Tubes, Slightly Used, \$12.00. L. S. Hutton, 125 E. Market St., Warren, Ohio.

**SELL:** Dictograph Loud Speaker, Ten Dollars; Radio Corporation Audio Transformers, Five Dollars. Clarence Jewett, 417 Franklin, Keokuk, Iowa.

**HAVE AN ENLARGEMENT** made of that favorite negative of your radio station and mounted at a reasonable price. T. Johnson, 15 Rosemont Rd., Worcester, Mass.

**HAMS:** Get our samples and prices on printed Call Cards, Letterheads and Envelopes. Hinds & Edgerton, Radio Printers, 19 S. Wells St., Chicago, Ill.

**HURRY**—2 Fifty watters \$17.00 Each. 1 250 Watter \$65.00. 3 Five Watters \$4.00 Each. 1/4 KW 500 Cycle Self Excited Alternator \$23.00. Sid Lohman, Greenville, Ohio.

**MAGNAVOX R3 OR M1.** Latest nationally advertised reproducers. List \$35. Introductory \$25. The factory sealed carton is your guarantee. Radio Central, Dept. Q, Abilene, Kansas.

**OHIO AND WAGNER** 60 cycle 110 V. synchronous motors \$18.00. Attachments to make synchronous rectifiers for C.W. transmission \$12.00. Acme plate transformers, King chargers, "A" and "B" batteries and other supplies on hand. Prices reasonable. Write Kimley Electric Company, Inc., 2665 Main St., Buffalo, New York.

**ONE QUARTER TO TWO KW** 500 cycle generators. With and without motors. Transformers, battery dynamotors, Bakelite inductances, Western Electric 50 watters \$25. Henry Kienzie, 501 East 84 Street, New York.

**FIFTY ASSORTED FLAT HEAD** solid brass machine screws, nuts, washers, copper lugs, 50¢. Eight initial binding posts, set 60¢. Twelve nicked binding posts 50¢. All three items \$1.50. **RADIO LIST** for stamp. All prepaid. Stamps accepted. Kladag Radio Laboratories, Kent, Ohio.

**CALLS HEARD POSTAL CARDS** (for DX reports). Send \$1.00 with your name, address and call letters for 100 printed report postal cards with large red call letters. Complete form for description of your station, etc. State if member of A.R.R.L. Samples on request. "Used Everywhere—Go Everywhere." The Radio Print Shop, Box 582, Kokomo, Indiana.

**FOR SALE:** Good regenerative receiver, det. and 2 step, with tubes, \$57. W. G. Klein, 20 Fairfield St., Springfield, Mass.

**10" PORCELAIN INSULATORS** (QST No. 6) only 90¢. Why pay more? Equal to No. 5 in tests. Aluminum rectifier plates 1x6 @ 7¢. \$6.00 per hundred. Any special size cut to order. Lorain Radio Supply Co., Lorain, Ohio.

**ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS**

**SELL** new Grebe CR-5 Receiver for \$45.00. Cost \$80.00. First money order or certified check takes same. H. R. Lord, Cambridge Springs, Pa.

**BARGAIN:** 1 KW spark transmitter complete \$30. Write SQZ.

**FOR SALE:** 2 Variometers and variocoupler Penn. C. Set with 2 step amplifier in separate highly polished oak cabinets. New \$80. Clayton LeGallez, Slingerlands, N. Y.

**FOR SALE:** 400 volt 250 watt motor-generator, runs on ball bearings off of a six volt storage battery. One fine buy, \$60.00 takes it. Box 605, San Luis Obispo, California.

**SELL:** 1/2 kilowatt spark \$25.00. 9DVK.

**FOR SALE:** 9CLZ's C.W. transmitter complete. DX 38 states worked. \$110. Send for photograph.

**FOR SALE:** Corona typewriter in excellent condition. \$25. D. Cason Mast, Nacogdoches, Texas.

**WANTED:** A 750 to 1000 Volt D.C. Generator. Radio 9EFE.

**SELL, 9AVP:** UP1016 Power transformer \$23.00; 3 UV203's New \$20.00 Each; Sockets for same \$1.50 Each; 2 Murdock Antenna switches \$2.00 Each; Jewell 0-15 voltmeter \$5.00; Benwood Sink motor 1/2 H.P. \$20.00, 1/2 H.P. Globe Heavy Duty Motor \$20.00; 1KW Acme non-sink spark transmitter complete \$25.00; R.C. Inductance \$7.00; Jewell \$25. 0-10 amps \$10.00; Chemical Rectifier 72 jar \$8.00; 1KW Marconi Coffin 30,000 volt secondary \$20.00; Coupling condenser \$1.00; Navy Key \$3.00; Vibroplex \$4.00; 200 watt filament transformer carry 4 fifty's \$8.00; Reinartz tuner (no cabinet), \$8.00; Three circuit, a beauty, \$20.00; Both with tube controls. Ship anything C.O.D. Willard McCulla, Waukegan, Illinois.

**SELL:** VT elevens, genuine audiotron, Myers and receptacle, \$5 each. 5 Amp. charger \$16. C. McDermott, Bellevue, Iowa.

**SELL:** Connecticut 500 Volt D.C. Generator, 375 watts, 2000 Revolutions \$15.00. Y-415 Reactance \$4.00. Two Dubilier 1000 Volt .002 Condensers \$4.00 each. .5 Amp. and 3 Amp. G.E. Radio Ammeters \$4.00 each. Connecticut Variable Condenser \$3.00 C. H. McKnight, 45 Lowell Road, Schenectady, N. Y.

**FRENCH FIFTY WATTERS.** 6 Volts 1,000. Bell-like clang. \$15. Brand new. Canadian 2BN.

**98% PURE ALUMINUM** for rectifiers \$1.50 per square foot. 9CSA, Box 15, Oak Park, Ill.

**SINKS**—New Stahl Sink Rectifiers \$50.00. Prepaid. Electrical Specialty Company, Valparaiso, Indiana 9DVK.

**FOR SALE:** Large stock of Radio apparatus. Write immediately for reduced price list. Box 565, Fort Dodge, Ia. Carlton Tennant.

**HAMS WHO DESIRE SPEED**—a moment's attention. Brother Ham whose limit was 15 words doubled his speed in One Evening. Send your Call and ask for the facts as told by himself. Dodge Radio Shortkut, Dept SC, Mamaroneck, N. Y.

**RADIO GENERATORS**—500 Volt 100 Watt \$28.50 each. Battery Chargers \$12.50. High Speed Motors, Motor-Generator Sets, all sizes. Motor Specialties Co., Crafton, Penna.

**LET ME PRINT** your QSL cards. Large call letters in colors. Printed to order at reasonable prices. Write for samples and price list. 5BP.

**MOTOR GENERATOR** Wanted. Cash or trade for Graflex or Victrola. 9DLY, Brillion, Wis.

**FOR SALE:** 100 Watt Broadcast Transmitter complete with microphone, tubes and Esco Generator motor driven. DX 2000 miles, can also be used below 200 meters. The Maus Piano Company, Lima, Ohio.

**MURAD** six tube set, MA thirteen, with finely finished loop for ninety-eight dollars. Cost \$176. In perfect condition. Bristol power amplifier for fifteen dollars. Three tube "All-Wave" set, with All-American transformers, Paragon sockets, Cutler-Hammer rheostats, "All-Wave" tuner, Posaco 43-plate vernier condenser

in fine mahogany cabinet. All for twenty-five dollars. One F.R.S. set, completely wired, for twenty-five dollars. Box 352, Palestine, Illinois.

**MICARITE CONDENSER**—Can be adjusted from .00025 to .006 M.F.D. Formica base & cover, copper plates, mica dielectric. Tested at 2000 volts. For transmitting or receiving. 75¢ postpaid. Radio frequency transformers—type S range 150 to 450 meters, —type L range 300 to 700 meters. \$2.50 either type postpaid. Nelson Radio Laboratories, 1773 Carlyon Road, Cleveland, Ohio.

**WESTINGHOUSE NAVY DYNAMOTORS @ \$15.00** Each. Spring rack \$3.00 extra. CN240 Long wave Navy receiver, \$85.00. 5 dial Omnigraph, \$12.00. Amrad Wavemeter, \$8.00. Acme 300 Watt Filament Lighting Transformer, \$14.00. Acme Two Stage, \$15.00. Rotary converter, \$10.00. W.E. Microphone \$2.00. 2 W.E. Amplifying Transformers, \$5.00 Each. 1/2 KW Navy Transmitting Key, \$6.00. Navy change-over switch, \$9.00. General Radio Modulation Transformer, \$3.00. 2 Large A.C. Voltmeters, 0-120 & 0-180 \$3.00 Each. General Radio Portable radiation Meter, \$8.00. Best offer takes the following meters: Weston 0-40 Amp., 0-3 Amp., Small 0-25 Amp. Jewell 0-300 Milliamp., 0-1 1/2 Amp. Thermo couple, 0-15 Voltmeter, D.C., Pyrometer, \$40.00. Tubes, 3 W.E. 50 Watt @ \$28.00 Each, 3 J Tubes @ \$6.50, 6 N Tubes @ \$5.75, 4 E Tubes @ \$7.00, 3 UV 202's @ \$5.50, 2 WD11's @ \$3.75, 3 Austrian Tubes @ \$4.00. All the above material is absolutely new. 2BYK, Philip Orein, 54 Cook St., Brooklyn, N. Y. Phone Stagg 9585.

#### MAKE \$120 WEEKLY IN SPARE TIME

Sell what the public wants—long distance radio receiving sets. Two sales weekly pays \$120 profit. No big investment, no canvassing. Sharps of Colorado made \$955 in one month. Representatives wanted at once. This plan is sweeping the country. Write today giving name of your county. Ozarka, 853 Washington Blvd., Chicago.

**FOR SALE:** 1/2 KW 500 cycle alternators \$80; 1 KW Crocker-Wheeler 500 cycle motor-generator \$110; 2 KW \$145; 250 watt tubes \$70 and \$90; General Radio wavemeter \$40; 1/2 KW 500 cycle alternator \$40; watt meters \$10; 1 KW 5000 volt 500 cycle transformers \$46; 1 KW 220 volt 60 cycle transformers \$40; 12,000 volt .002 mfd. condensers \$5.50; Advance sink rectifier \$35; Navy receivers and other high power transmitting apparatus. Edward Page, Baldwinville, N. Y. 8AQO-8XAV.

**SELL NEW** Radio Corporation No. 1368 transformer. Perfect condition, \$15. Lyle Palmer, Boonville, N. Y.

**FOR SALE:** 350 Volt Generator \$15.00. French Army Variable Condenser .0022 Mfd. semi mounted with calibration curve \$10.00. RCA C.W. Transformer UP-1368 \$20.00. Lots of Five Watt Stuff. Write for list. No. C.O.D. F. W. Paul, 472-98th Street, Woodhaven, L. I., N. Y.

**1000 VOLT, 500 Watt, Direct Current Generator** Price \$50.00, one 500 Volt, 200 Watt machine, Price \$30.00. Complete with field rheostats and pulleys. Also several motor generator sets 500 to 1500 Volts, like new, bargains. We have a few 250 Watt filament transformers, price each \$9.00. 500 Watt, Price each \$12.00. Queen City Electric Co., 1734 W. Grand Ave., Chicago, Ill.

**GREBE CR-7** 500 to 25,000 meter receiver. A-1 condition. Cost \$210.00. First money order for \$75.00 gets it. H. B. Wooten, Coldwater, Miss.

**PURE SHEET ALUMINUM** and lead 1/8", 75¢ square foot. Electrical Specialty Company, Valparaiso, Indiana. 9DVK.

**FOR SALE:** Valley Battery Chargers, Type AB Ten Dollars; 4 inch Radion Dials 39 cents; Standard tube sockets composition 41 cents; 50 Watt tubes slightly used, twenty dollars; Omnigraph 5 record size ten dollars. Radio Supply Co., Sedan, Kansas.

**AMATEUR RADIO STATION-ERY.** 100 letterheads and 100 envelopes printed on good bond paper, special radio size, \$1.65. Send copy for name and address and station call. Printed by 9AVO (member A.R.R.L.). Samples on request. Radio Print Shop, Box 582, Kokomo, Indiana.

**COPPER BRAID**—best conductor known for RF circuits. Surface is what counts. Many mechanical advantages over solid wire ribbon or tubing. Ideal for

CW inductances, loops, OT's, pig-tails, lead-ins, etc. Twenty sizes. No. 16 for wiring receivers, fifteen feet for 50¢. 9CZP.

**FOR SALE:** One short wave regenerator complete. \$30. Marshall Rife, Meriden, Illinois.

**FOR SALE:** Stock brand new genuine Radiotrons No. 201 while they last at \$3.00. Also WD11 & 12 new at \$3.00. Also new well made 10-20 watt phone, C.W. or I.C.W. with 5 tubes Hartley-Heising with speech amplifier, built-in, panel type, complete minus D.C. \$125. Also complete portable cabinet receiver 200-500 meters and amplifier, DX coast to coast, used, but in new condition minus accessories \$30, worth \$70.. Also cabinet receiver 1 stage tuned R.F. detector and 1 stage audio, minus accessories, solid mahogany piano finish, bargain \$35. Other cabinet receivers and parts less than wholesale. D.C. motors and lighting generators 36 watt to 5000 watt. Tesla Coil five feet long in 2 sectional drums delivers 3 foot spark largest in south, primary 4 ft. diameter, for use with wireless transformer 1 to 3 KW for stage or experiments. Price \$75. 2 new 50 watt radiotrons \$20 each or trade. 1 Kenotron UV217 used 6 hours \$15., or trade. All apparatus guaranteed as represented. Send 25% deposit, balance C.O.D. REAL Florida coconuts, in natural outer husk, good eating, fresh, and will grow in Northern hothouse, 25¢ each, plus parcel post on 2 lbs. Quantities by freight. Write for prices. Kenneth Richardson, Associate I.R.E., Box 1013, Fort Lauderdale, Florida.

**RADIO CALL CARDS** printed to ORDER. Red call, black printing. 100, \$1.75; 200, \$2.75, prepaid. Color changes 35¢ extra. Government postals 1¢ extra each card. LETTERHEADS 8 1/2 x 5 1/2 AND ENVELOPES, 100 EACH, \$2.25; 200 EACH \$3.50. A.R.R.L. emblem used on cards or stationery if requested by members. Send TODAY. Department 11-C, Radio Printers, Mendota, Illinois.

**FOR SALE:** 3 pr. head phones, Books on wireless, one large and one small Westinghouse Rectigon Battery Charger, Magnavox. (Set of Marconi Wireless telegraphy double face records—six in set.) Omnigraph, lot Radio Magazines, Radio wet battery, also lot of parts and supplies. Lock Box 708, Calumet, Iowa.

**HAMS:** Let 9EBH have your orders for Acme, Radio Corporation, Thordarson, Jewell, General Radio, Baldwin, Brandes, Grebe, Federal and practically all other leading makes of radio transmitting or receiving apparatus. 10% discount on all goods. All apparatus shipped prepaid. Edward Gieseke, Radio 9EBH, 312 So. Liberty St., Elgin, Ill.

**DEFOREST RECTIFIER** tubes handle 1000 volts, 20 watts, used slightly, \$3.00; Electrose 4 in. dials, new \$0.50. Everything prepaid. Rubidge, Mountain Lakes, N. J.

**CARICATURE** of yourself in action for your radio room. Send photo and two-fifty. Cartoonist Schmidt, Sinton Street, Portsmouth, Ohio.

**FOR SALE:** Omnigraph No. 2, ten dials, practice key and buzzer, eighteen dollars; Radio Corporation loop, fifteen dollars; Atwater-Kent variocoupler with panel, ten dollars. All guaranteed absolutely new. Emmons Stone, 39 Franklin Ave., New Rochelle, N. Y.

**SWAP**—Complete 1 KW inclosed rotary spark set in perfect condition. \$25. 6BRC.

**SIXTY CYCLE** one eighth horse new motor \$10.00. 460 watt 32 volt generator slide base pulley \$25. fine charge batteries lighting or use as motor, 250 watt tube \$70. Shaw, Marathon, Texas.

**\$110.00 EDISON CHROME NICKEL** 6 volt 150 ampere hour storage A battery at \$22.95. A wonderful battery at an equally wonderful price. 6 volt 330 ampere at \$37.90. Edison Type A (large size) B battery plates at 4¢ per pair. Type G's at 3¢ per pair. Parts for making rechargeable B storage battery from Edison plates (Type A) for 100 volts at \$8.95, 150 volts at \$12.95. Consists of plates, glass vials, special wire, perforated separators, chemical electrolyte and simple instructions for assembling and making charger. B. Q. Smith, 31 Washington Ave., Danbury, Conn.

**SPECIAL MID SEASON SALE:** UV 199's, UV 201-A's, WD11's, WD12's, \$5.75 each; UV 200's and 201's \$3.75; 100 A.H. Cooper Storage "A" Batteries \$13.50;

Crosley 80 A.H. Storage Batteries \$12.00; R-3 Magnavox \$24.50; Magnavox Power 2 step \$30.00; Piezo-phones loud speakers \$4.50; RCA Potentiometers (200 ohm) \$1.00; UV 1714's transformers \$3.50; UV 712's \$4.00; Standard (Packard) transformers \$3.00; Stromberg-Carlson, Brandes Superior, Federal and Roller Smith head sets, \$5.00 each; Marshall-Gerken variometers (moulded) and variocouplers, \$3.00 each; Paragon sockets and rheostats, 50 cents each; Clapp-Eastham H.R. and H.Z. units, \$20.00; Crosley receiving sets (150 to 700 meters) mahogany cabinets, \$10.00 each; Consolidated Call Book Regenerative Receiver Plans No. 1, 10 cents each; 2 step amp. plans No. 2, 10 cents each; 14 Radio Diagrams, 10 cents each; Homchargers, \$13.00; Riggs Rectifiers, \$9.00; 2 Amp. Tungars, \$13.50; Aeriola Jr. Complete with aerial equipment, \$35.00; Aeriola Sr. Complete, \$12.00; Federal Jacks, any type, 30 cents; Federal Plugs, 50 cents; Pacent Multijacks, 80 cents; No. 14 copper aerial wire, 200 ft. coil, 50 cents; porcelain insulators, 10 cents; Westinghouse aerial equipment, \$3.00; Marshall-Gerken Detector unit, \$3.00; Amplifier units with All-American transformer, \$4.00 each; Formica panels  $\frac{1}{2}$  in. thick, 6x12, 6x18, 6x19, 6x21, 8x12, 9x12 and 12x14 inches,  $\frac{1}{2}$  cents per sq. inch; Micadon condensers, any value 20 cents. We ship C.O.D. if you desire. Leon F. Shell Co., New Washington, Ohio.

NEW VT2 \$8. Omnigraph \$15. Two Kenotrons \$5 each. Never used. Old Telefunken direct reading wavemeter 300 to 3200 meters \$20. Navy transfer switch 2 KW \$5. Radio 3BEM.

SELL: Zenith regenerator, good condition. \$35.00. Write Spencer Shotwell, 1450 Victoria Ave., Lakewood, Ohio.

TRADE—COMPLETE  $\frac{1}{2}$  KW spark. Cost \$85. For receiving apparatus. Geo. H. Smith, Charleroi, Pa. Ex-8QG.

FONE TRANSMITTER, 8KG HOOK-UP, 10 watt oscillator, 10 modulator, 10 speech amplifier, or 20 watts straight C.W., 150 watt Esco motor-generator, cost \$250.00, sell \$150.00. Motor-generator separate \$50.00, SELL OR SWAP for synchronous rectifier, new Remington Portable Typewriter, cost \$65.00. Harold Schearer, 733 Madison Avenue, Reading, Pa.

SELL: Jewell 500 volt D.C. motor, pattern 54, mounted, \$12.00. 83 ft. sectional steel tower & antenna \$50.00. Magnavox Tone Arm, \$15.00. German Phones, \$10.00. Geo. Sawyer, 356 Hazelwood Ter., Rochester, N. Y.

FREE: 50 watt tube to the Ham who buys my Esco 1000 Volt 200 Watt M.G. \$90.00. 2DD. 8 Swan St., Schenectady, N. Y.

NAVY TYPE C.W. 936A Transmitter and Receiver complete including remote control system, Power amplifier, Loudspeaker, Phone transmitter, two generators, Switchboard, Spare part box, etc. No tubes. Bargain \$150.00. Nathaniel Tylee, 314 Sumter St., Charleston, S. C.

FOR SALE: 1/6 H.P., 220 volt, 25 cycle, Champion Motor. Used but in good condition, \$12.00. Will trade for good 200 watt C.W. transformer. Carlton Tennant, Box 565, Fort Dodge, Iowa.

MOTOR GENERATOR for sale. Esco 200 watt 400, 600, 1000 volts. Four bearing, double commutator. Operates on 110 volts, 60 cycle. Purchased new August, \$90. Ellison Thompson, 1301 Findley Ave., New York, N. Y.

SOME BARGAIN: New Fada Neutrodyne receivers, 2 radio, detector, 2 audio, \$80. List for \$120. Also Tungar 10 battery rectifier, slightly used, \$50. Tully Battery Co., Tully, N. Y.

SALE: New Grebe Rork 2 step amplifier, with tubes, \$45.00. Radio 9CIN.

HERE'S A REAL BARGAIN: New Paragon RA-10, receiver, DA-2 detector and two-step amplifier. \$65. Good reason for selling this at this price. U. of I. Supply Store, Champaign, Illinois.

TRANSMITTERS AND RECEIVERS overhauled, repaired, rebuilt and made to "percolate." Any circuit. Twelve years experience and up-to-date. 9CZP.

30 WATT CW-FONE transmitter on bakelite, complete with Motor Generator, tubes, etc. \$250. 500 watt 150 watt Motor Generator almost new, \$40.00.  $\frac{1}{4}$  H.P. 1750 32 volt motor, new \$12.00. Want 1,000-

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1,500 Motor Generator. "The Radio Parson," Greentown, Indiana.

FOR SALE: Regenerative set, 2 step amp. phones, bulbs, Bodine 24-volt Generator and other apparatus, cheap. Write for details and prices. F. A. Wimmer, 3916 N. Irving Ave., Chicago, Ill.

BIG BARGAIN: UV 199, UV 201A, WD11, WD12, \$5.65; Loud Speaker with Baldwin Unit, \$11.00; Freshman Variable Grid Leak with Condenser, \$0.80; \$10.00 Phones bought at auction, \$4.00; Rheostats up to 40 ohms, \$0.50. Everything postpaid. Anything in Radio line cheap. Walter Wickstrom, 2224 Melrose Street, Chicago, Illinois.

BARGAIN: OARD PHANTOM RECEIVER New Portable. At less than half price. \$85.00. Act quickly. Webster Electric Co., Racine, Wis.

THREE W.E. 216-A tubes, never used, original packing \$15.00. H. B. Wooten, Coldwater, Miss.

HERE THEY ARE FELLOWS. Edison element storage batteries. Complete in attractive dust and acid proof cabinet, electrolyte and handles.  $4\frac{1}{2}$ " surface between cells. The last word in storage "B" battery design. 22 volt battery \$3.25 48 volt \$6.50. 72 volt \$9.50. 100 volt \$12.25. Prepaid anywhere in the U.S.A. Shipped from stock. Send for circular. For this month I am offering Type A elements wired with heavy nickel plated iron wire at 6¢ per pair.  $\frac{3}{4}$ x6 containers 3 $\frac{1}{2}$ ¢. 1x6" containers 4 $\frac{1}{2}$ ¢. Separators  $\frac{3}{4}$ ¢. 5 lb. can electrolyte \$1.50. Everything for that storage "B." J. Zied, 530 Callowhill St., Phila. Pa.

EDGEWISE WOUND Copper Ribbon  $\frac{1}{8}$  inch wide 6 inch diameter 15¢ turn,  $\frac{1}{8}$  inch wide, 5 inch diameter 12 cents turn, any number turns one piece. Remler Giblin Coils mounted 25-75-100-150-200-250-300-400-500-600-750-1000-1500 turns, half price. Genuine Silicon Transformer steel, cut to order, 25 cents pound, 10 lb. and over, 4 cubic inches to lb. Postage extra. Geo. Schulz, Calumet, Mich.

## QRA SECTION

50c straight, with copy in following form only: CALL-NAME-ADDRESS. Any other form takes regular HAM-AD rates.

1BGK—R. B. Conaughty, Army Navy Y.M.C.A., Newport, R. I.

1BJB—S. Forrest Martin, The Choate School, Wallingford, Conn.

1UO—Amateur Radio Club, at Wesleyan Univ., Middletown, Conn.

2ADH—E. Peacock, 52 Radford St., Yonkers, N. Y.

2AG—C. R. Runyon, Jr., 544 North Broadway, Yonkers, N. Y.

2CZD—J. H. O'Connor, 25 Cortland Ave., New Rochelle, N. Y.

3CKL—E. D. Gray, Church St., Blacksburg, Va.

3CKK—Frank E. Vaughan, R.D. No. 4, Box No. 115A, Hampton, Va.

3ZI-3CS—Ed. G. Raser, 931 Edgewood Ave., Trenton, N. J.

4FZ—Thos. H. Hall, 117 Oak Haven Ave., Macon, Ga.

4IU—W. Justice Lee, Ortega, Fla.

4JR—Robert S. Morris, 413 S. Broad St., Gastonia, N. C.

5OT—A. B. Tinsley, 1317 Allen Ave., Ft. Worth, Texas.

5XAC-5UE—Ben H. Woodruff, Conway, Arkansas.

6BLZ—T. W. Kelso, 305 South Eye St., Madero, Calif.

6TF—L. E. Furrow, 322 W. 54th St., Los Angeles, Cal.



6ZAT—Lyndon Farwell, 55 Broadway, Los Gatos, Calif.

6SN—M. Kingdon Weller, 618 West 4th Street, Los Angeles, California.

7PK—Henry Bauer, Uniontown, Washington.

8ANL—W. K. Fischer, 7711 Guthrie Ave. N.W., Cleveland, Ohio.

QRA-SANM—H. J. Crisick, W. Washington St., Medina, Ohio. QRK? All cards answered immediately.

QRA of 8AOT is 15 South McNab Ave., Gloversville, N. Y., not 2515 Braddock Ave., Swissdale, Pa., as published in Citizens Radio Call Book. All crds. ans.

8APE—Norman W Smith, 8058 Chamberlain Ave., Detroit, Mich.

8AZT—Reassigned to B. Buckingham, 195 West Eleventh Avenue, Columbus, Ohio.

8BBI—W. Guy Watson, 457 Florence Ave., Royal Oak, Mich.

8BCB—Ed. J. Kensler, 415 W. Chicago St., Sturgis, Mich.

8BHF—R. B. Greenman, 26½ Lincoln Ave., Cortland, N. Y.

8BJY—Ralph M. Cook, 588 Norton Way, Bucyrus, Ohio.

8BWC—Alto Hoover, 141 W. Main St., Norwalk, Ohio.

CUBAN 8GT—Juan E. Chibas, G. Portuendo baja 12, Santiago de Cuba, CUBA.

8GX-8ZE—Everett W. Thatcher, Oberlin, Ohio.

9ATT—Claude B. Vail, 607 N. Diamond St., Jacksonville, Illinois.

9DRY—Clyde A. Dolson, P.O. Box 167, Trinidad, Colorado.

9ELV—Justin W. Blauert, 498 13th Ave., Milwaukee, Wisc.

9UB is H. Harrison, Angola, Ind. Correct Ur. Citizens Call Book.

## FEATURE OFFER

Variometers with Dials...\$2.50

Loose Couplers..... 4.90

Complete parts and Hookup Diagram including Bakelite Panel and Phones.

Special prices on all apparatus in our Special Bulletin.

Send for this.

**Whitall Electric Co.**  
WESTERLY, R. I.

## WAVE LENGTH! Do You Know Yours?

If not, let us calibrate that wavemeter of yours.

We specialize in calibrating wavemeters, inductances, condensers and other radio apparatus. Our laboratory equipment is such that we can undertake tests on all types of radio apparatus.

We guarantee as accurate calibrations for this special work as is obtainable from the Bureau of Standards. This guarantee together with reasonable calibration fees and prompt service commends our Laboratory to the wide awake experimenter or manufacturer.

Manufacturers interested in perfecting their radio products or obtaining design data on new types of apparatus will appreciate our facilities for undertaking such work.

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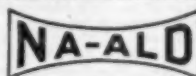
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DeLuxe  
Contact



Na-ald DeLuxe  
No. 400



### De Luxe Socket

The laminated phosphor bronze contacts of the Na-ald De Luxe Socket press firmly on both the ends and sides of tube prongs, keeping the surface clean and insuring clear reception.

Moulded of genuine Bakelite this socket expresses the very highest quality in appearance and workmanship.

ALDEN MANUFACTURING CO.  
Largest makers of Radio Sockets and Dials in the world.

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### "WARRANTED" Audio Transformer

MTD. \$2.00 UNMTD. \$1.45

10 Days Money Back Guarantee  
Dealers Write

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Ohio Brass Co. porcelain antenna insulators 5" 75¢, 10" \$1.50, Corona bushings if requested, Corona shields \$1.00, No. 12 solid copper enameled aerial wire. Lowest hifrequency, and no corrosion losses. 1¢ a foot prepaid. Grebe CR-13. A real receiver for relay men. \$95 prepaid. 250 watt Western Electric transmitting tubes \$75. Radio 8ML, 4837 Rockwood Road, Cleveland, Ohio.



—FOR YOUR CONVENIENCE—

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ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

# Radio Broadcast Contest reveals Bradleystat supremacy for Long Distance Reception



RADIO Broadcast recently conducted a prize contest, open to all radio enthusiasts, for the purpose of interesting amateurs in long-distance reception. Ninety contestants were entered, and the names of all, including prize winners, were published in several issues of Radio Broadcast, after the contest closed.

## How the remarkable Bradleystat records were discovered!

AFTER the names were published, a letter was written by the Allen-Bradley Co. to each contestant to ascertain what filament rheostat was used in each radio set. Seventy-two reports were received, and after they were tabulated, the most amazing discoveries were made about Bradleystat performance and Bradleystat popularity.

## The Bradleystat captured first place in all leading events!

The superiority of the Bradleystat was proved, conclusively, by these facts:

1. The First Prize Winner used the Bradleystat in his set.
2. The greatest mileage record of 303,420 miles, total, was made by a Bradleystat user.
3. The Bradleystat was the most popular rheostat in the entire contest.
4. More Bradleystats were used than the next four types of rheostats, combined, "see diagram."
5. No carbon or metallic powder rheostat was reported in competition with the Bradleystat in this record-breaking contest.

Your radio set needs a Bradleystat. Try one tonight!



**\$1.85**

IN CANADA

**\$2.50**

PARCEL POST  
10¢ EXTRA

## Bradleystat Leads by Big Margin



### Analysis of Returns

Each line represents a different type of rheostat used in the contest. The numbers indicate how many of each were used. Note the overwhelming popularity of the Bradleystat, first on the list.

**Allen-Bradley Co.**  
Electric Controlling Apparatus

277 Greenfield  
Avenue



MILWAUKEE,  
Wisconsin

THE ALLEN-BRADLEY CO. HAS BUILT GRAPHITE DISC RHEOSTATS FOR OVER 20 YEARS



## The Golden Rule Tube

The discovery of the principle upon which the Sodion Tube was developed marks a new and better Era in Radio.

The tube itself is different from any you have ever known.

Different in principle—different in operation and different in results.

As its name implies, it makes such effective use of the peculiar properties of the sodium ion that there is no need of regeneration to build up the strength of your reception.

The fact that it does not oscillate not only eliminates all semblance of whistles and howls in your own reception, but makes it impossible for you to interfere with the reception of others. It is the practical application of the Golden Rule to Radio.

Crystal tone reception.

Unusually sensitive to weak signals.

Stable and uniform in operation.

Runs for hours without adjustment.

Operates on dry cells or storage battery.

*Bulletin A-100 upon request*



**CONNECTICUT**  
MERIDEN

TELEPHONE  
& ELECTRIC  
Radio Division

**COMPANY**  
CONNECTICUT



# AMRAD

## OWNERS DELIGHTED WITH "S" TUBE



Improved AMRAD "S" TUBE No. 4000  
Price \$10.00

### No Filament to Burn Out SPECIFICATIONS IMPROVED "S" TUBE

#### Rating per tube—

Current: 100 Milliamps.  
Voltage: Up to 1000 volts  
DC  
Life: 3000 Hrs. (Very  
conservative)

Operates CW Transmitters, utilizing either 5 or 50 watt power tube.

May be used to charge storage "B" batteries.

Fits standard base.

A 100% rectifier.

*Write for new Bulletin J-2 describing the "S" Tube and containing diagram showing methods of connecting tubes for obtaining various voltage and current.*

"I believe I was the first station in town to use "S" Tubes. I bought two old style from the Braun Corporation here, and used them for three months on 15 watts. They were passing 100 Mil. at 1800 volts steady every day for three months, and stood it fine. I sold them a month ago for \$12.80 second-hand. While using them I was heard in Greenland by WNP and in Honolulu by KHL... I had the purest DC in town. But soon after I shot three filter condensers (not yours) and wasn't able to afford new ones... Now I want full information and hookups on the Improved Type of "S" Tube."

(Signed) W. H. Hardy (Radio 6CMS)  
4928 7th Ave., Los Angeles, Calif.

"Enclosed find money order for two solutions of your Merphon Electrolyte... While writing I might say I am more than pleased with the "S" Tube. I am using 5 watts now instead of 10 and among the best stations worked are 9DMJ, 9BJR, 8CYO, 1MY, 1AOO, 2WR, 2BNZ, 3BWT, 3CHG, Canadian 2BE and 2BN. I have a very good radius and my note is excellent, not causing the least bit of interference to BCLs. About the most remarkable record is that I have heard SEVERAL times in one evening by 3NF, Richmond, Va., on a single circuit detector only WITHOUT ANTENNA OR GROUND, Hi."

(Signed) Canadian 3SP

50 Lorne Crescent, Brantford, Ont.

"Yours of the 18th regarding shortage of "S" Tubes received. Have been hoping to receive the last two orders, but as yet they have not arrived. They sure work great. The two I have are doing splendidly and are running on about 50% overload (We do not advise overloading)... At distances over 150 miles they all think I have a filtered DC generator. I am using phone now, and even at distances of 30 to 50 miles, the modulation is reported very good."

(Signed) Edmond Crocker,  
Nantucket, Mass.

These are typical of the letters we are receiving from all parts of the Country and Canada. And these letters refer to the former type—NOT THE IMPROVED No. 4000. Owners of "S" Tubes tell their friends about the wonderful results they are obtaining. We are always glad to receive these reports.

Go to your dealer and demand "S" TUBES, but if he does not stock or you are not near one, send your order with remittance direct to us, and we will ship promptly.

The "S" Tube is fully guaranteed or money back.

Write for Descriptive Bulletin J-2

## AMERICAN RADIO AND RESEARCH CORPORATION

205 College Ave., Medford Hillside, Mass.

AMRAD Dealers in Principal Cities and Towns